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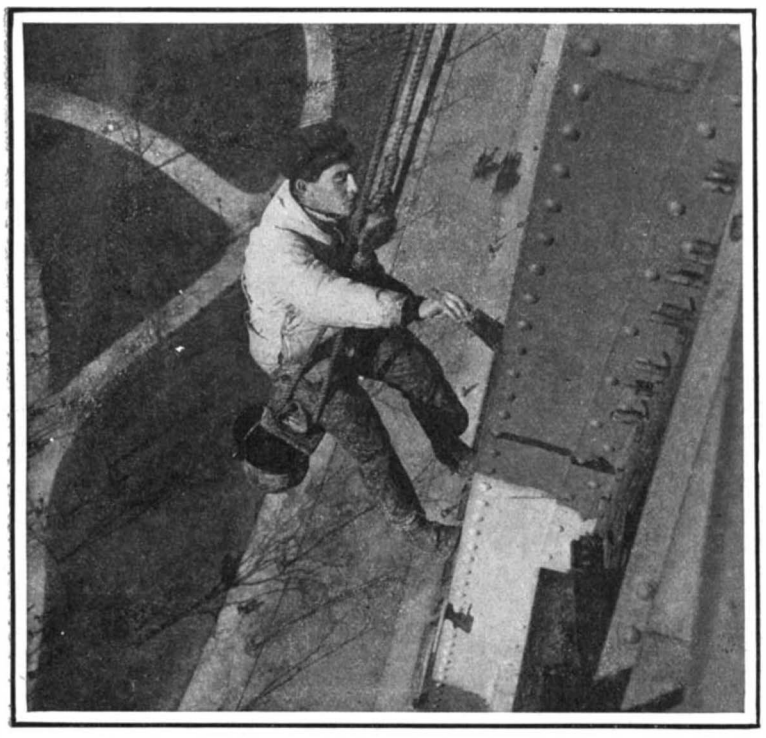
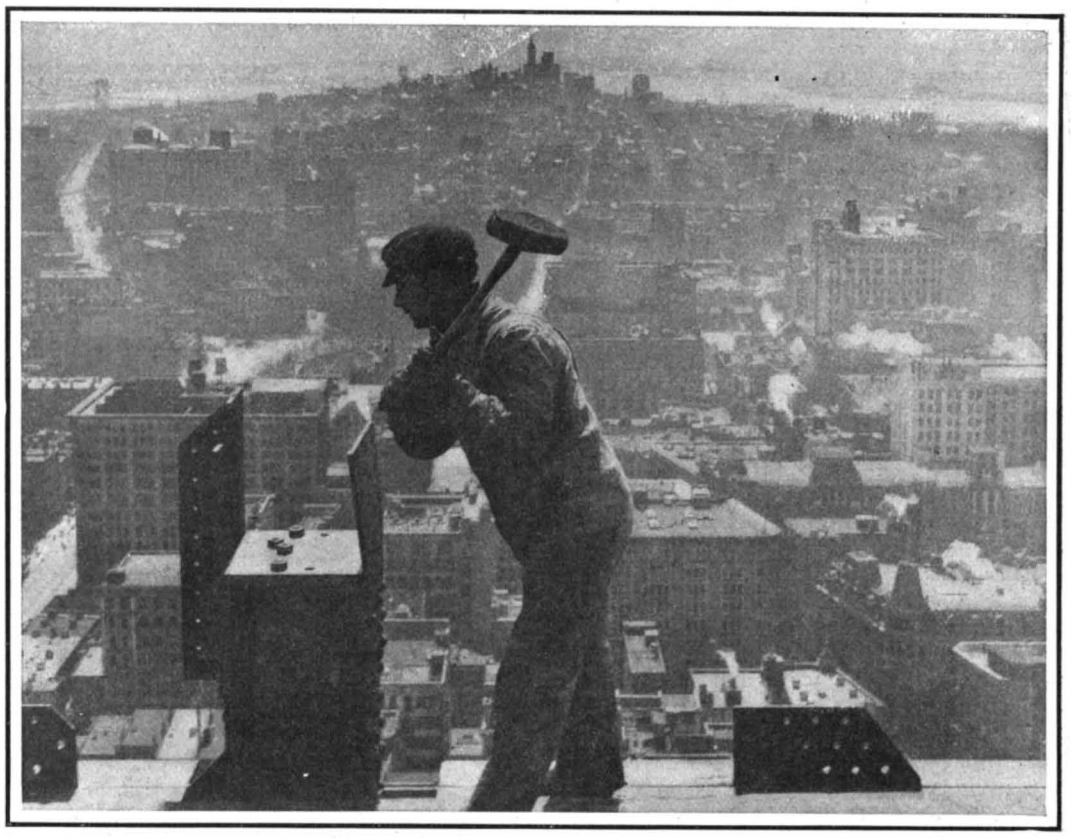
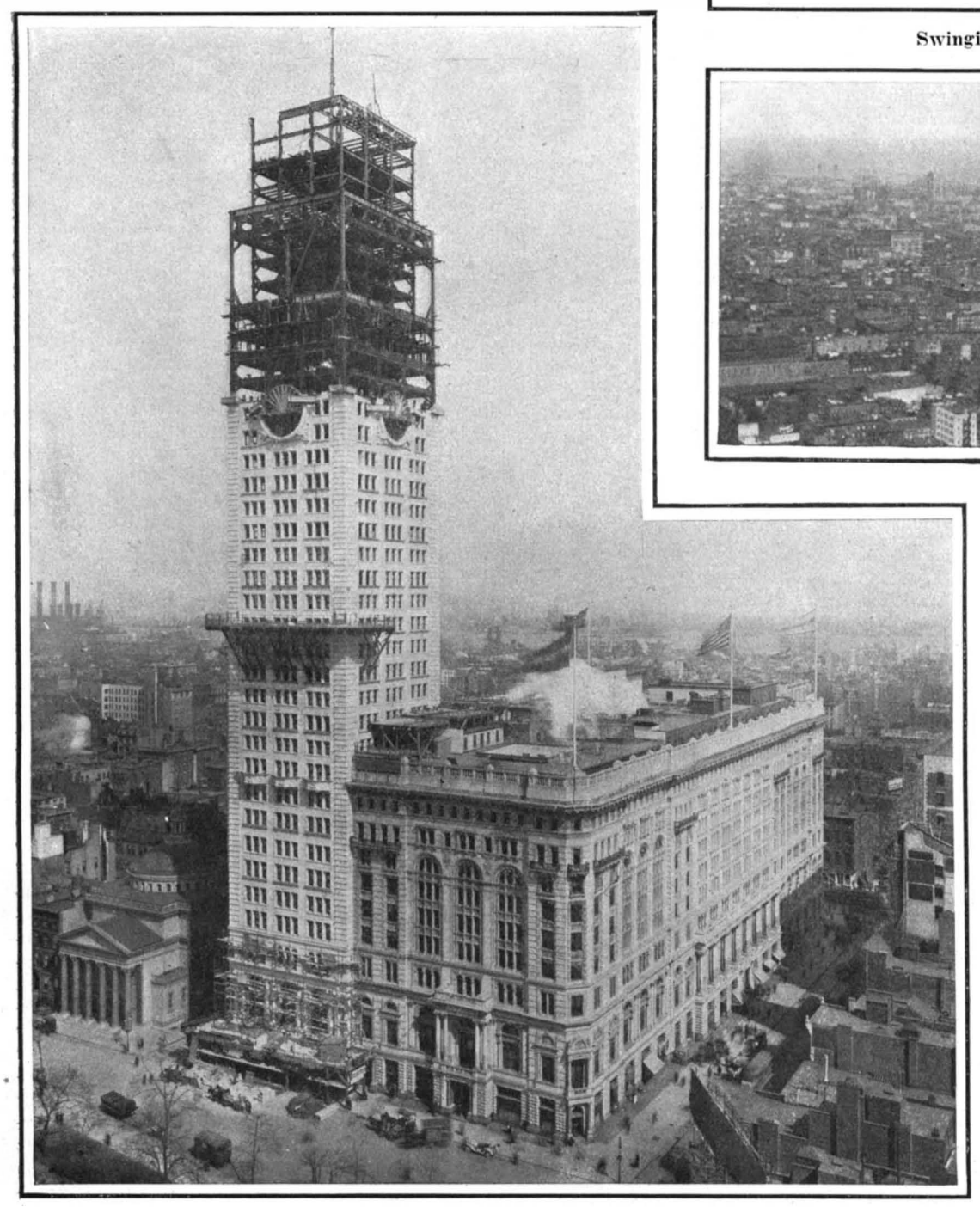


The Finishing Coat of Waterproof Paint.

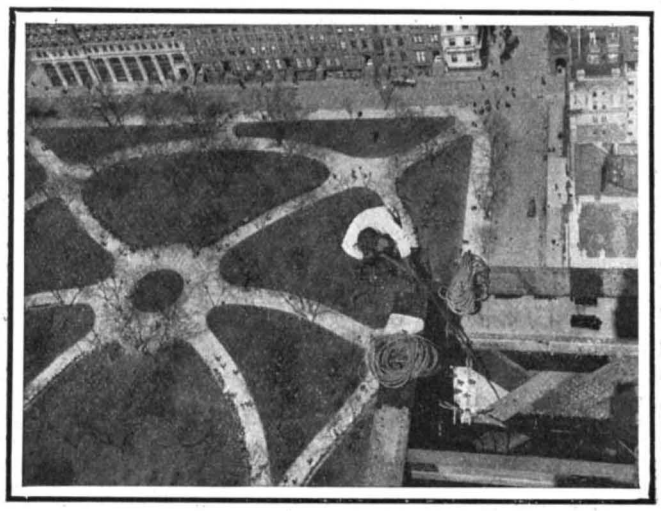


Swinging the Sledge, Five Hundred Feet in Midair.

On the Top of the Topmost Column.



Erection of the Great Tower, with the Marble at 324 Feet, and the Steelwork at 500 Feet Above the Sidewalk.



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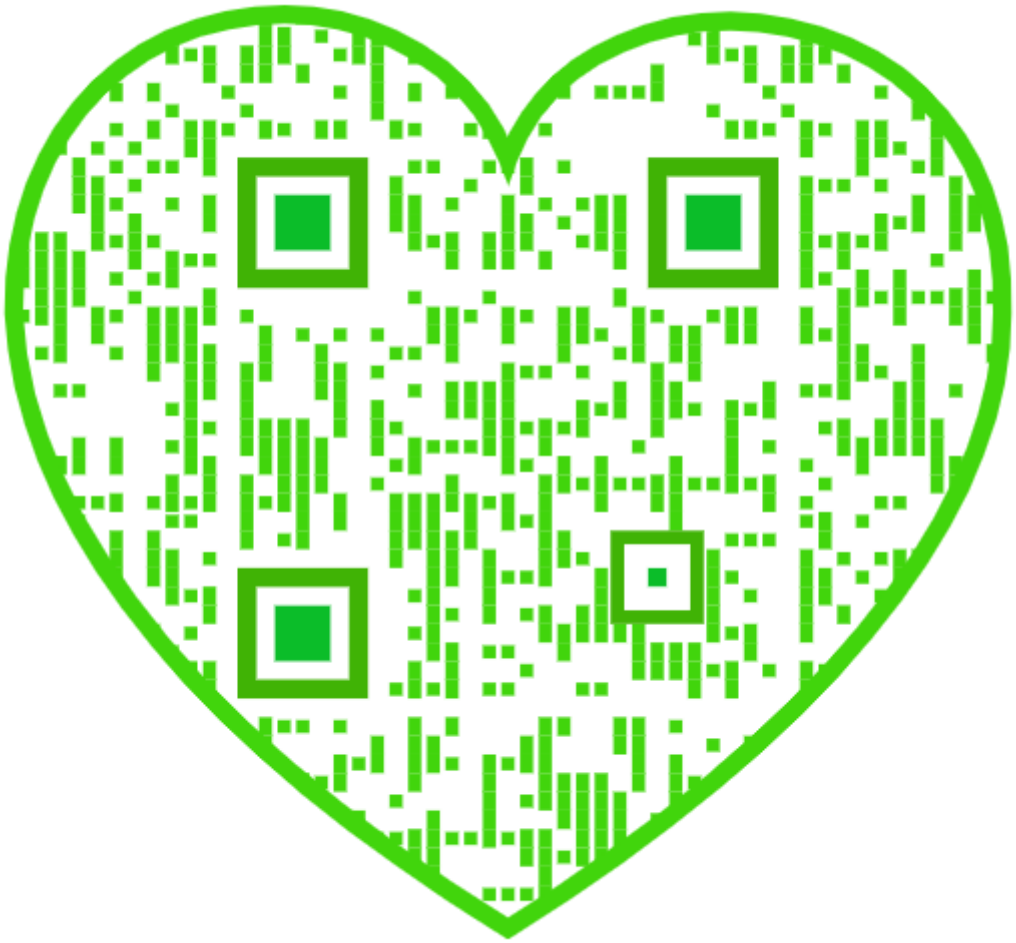
Bird's-eye View of Madison Square.

A NEW YORK CAMPANILE 700 FEET HIGH.—[See page 310.]



SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MAY 2, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SIR WILLIAM WHITE ON THE AMERICAN NAVY.

In the course of a recent conversation with Sir William White, the Editor of the SCIENTIFIC AMERICAN asked the distinguished naval architect for his estimate of the relative value of the ships of the United States navy compared with those of the leading navies of the world. He replied that, if a comparison were made of ships of the same date and the same type, he considered that the United States vessels were the equals of any warships afloat.

Now, the value of this approval lies in the fact that Sir William has had a more intimate and extended experience in the design of modern warships than any living naval architect. For a period of about twenty years he was the Chief Constructor of the British navy. What Ericsson was to the low-freeboard, coast-defense monitor, White is to the modern, high-freeboard sea-going battleship; and in the "Royal Sovereign" he introduced a type which, for two decades, has formed, in most of its essential features, the standard battleship for the leading navies of the world. In his active career he has designed a greater number of battleships and cruisers probably than any three naval architects combined.

Sir William informed us that he had followed the Senate investigation of the supposed defects in our ships with much interest, and that he disagreed with the charges as originally stated in the Reuterdahl article. Taking the case of the "Dreadnought," which was cited as an instance of how our own ships should have been armored, but were not, he made the startling statement that whereas, at full load, the American ships are depressed on an average 27 inches below the nominal flotation line, the "Dreadnought," when so loaded, was depressed from four to four and a half feet; and that whereas at full load the American ships show from six to nine inches of the thick belt above the water, the English ship has the corresponding belt from a foot to a foot and a half below water! He further stated that whereas *in the fully loaded condition the "Dreadnought" shows only four to four and a half feet of 8-inch side armor, the "Connecticut" and class show from fifteen to sixteen feet of 7-inch side armor above the water.* Therefore he considered (as well he may) that the "Connecticut" is better protected than the "Dreadnought."

Even more disastrous to the critics of our navy were the comments of Sir William on the question of the direct *versus* the interrupted hoist. Mr. Reuterdahl *et al.* have stated, time and again, that the direct hoist, giving direct communication from the handling room floor to the breech of the gun, is a type of construction *peculiar to our own navy*, which is full of danger; and they have urged that it should have been abandoned long ago in favor of the interrupted hoist, which according to them was introduced in foreign navies to avoid the dangers inherent in the direct hoist. Thus, Mr. Reuterdahl in his recent letter to the New York Sun, referred to in another column, states that there is not in any foreign turret a hoist of the type we use. Now, upon this point no one is so qualified to speak as Sir William; for he informs us that it was he himself who designed the interrupted hoist *nearly twenty years ago* (the critics have told us that this was a comparatively modern improvement, which our slow-moving department has refused to adopt) *and that he did not design it because the interrupted hoist was less dangerous, but because he believed it would secure a faster service of ammunition to the guns!* He stated furthermore *that the majority of the armored ships of the world make use of the direct hoist and that it is in no sense peculiar to the United States navy.*

And thus once more are the fallacies and the absurd exaggerations of this ill-advised onslaught upon our navy shown to be not only baseless, but positively absurd—this time by one who is at once the foremost naval architect of the day and an outside critic of unquestioned impartiality. Let us hope that with this final and truly comic pricking of the "open hoist" turret bubble, the American public will be granted a well-earned repose.

THE SENATE, THE SCIENTIFIC AMERICAN, AND THE NEW YORK SUN.

We are indebted to Mr. Reuterdahl for having drawn our attention, through a letter to the New York Sun, to the fact that the United States government has done the SCIENTIFIC AMERICAN the honor of printing its recent editorial, summing up the results of the Senate Hearing on Alleged Battleship Defects, in the Congressional Record, thus constituting it a government document.

The compliment is of such an unusually high character, that our esteemed contemporary has been moved to devote a lengthy editorial to the matter—a flattering attention for which we hereby beg to tender our sincere acknowledgments.

So richly is our contemporary anointed with the sweet oil of compliment, that it has even hinted, with that delicacy and refinement of editorial good taste which of late years has been one of its choicest attributes, that the SCIENTIFIC AMERICAN stands in a favored relation to the United States government, a relation proved by the desire on the part of the chairman of the Senate Naval Committee "to palm off the SCIENTIFIC AMERICAN'S article" (we revert to the choice diction of our contemporary) "as a document of official or semi-official importance."

The supposed relation of the SCIENTIFIC AMERICAN to the government is stated with more elaboration in the following extract from the Reuterdahl letter above referred to:

"It will not be difficult to trace the connection between the SCIENTIFIC AMERICAN and the Bureau of Construction. For many years that periodical has enjoyed the unusual privilege of publishing before any other newspaper the official plans of our ships. These plans came from the Bureau of Construction. It is only natural that the SCIENTIFIC AMERICAN should speak well of those who have been friendly and helpful to it."

As further evidence of our appreciation of the kindly interest shown by the New York Sun, Mr. Reuterdahl *et al.* in the secret relationships of the SCIENTIFIC AMERICAN, we have selected from our files the following illuminating correspondence bearing directly upon the question at issue. On November 25, 1905, the Editor, in answer to his complaint that the daily press of this city was receiving information regarding the newly-authorized "South Carolina" and "Michigan," which the SCIENTIFIC AMERICAN was unable to obtain, received the following reply from the Chief of the Bureau of Construction and Repair: "Yours of recent date in relation to the designs of our new vessels at hand. I have no means whatever of knowing by what method the Herald obtained its information, but as plans were sent to various Bureaus, Boards, etc., it is possible that they obtained some definite information. The Department does not desire that these matters be made public at this time."

After reading the Reuterdahl article in the January number of McClure's, the Editor was satisfied at once that it would be a simple matter to point out the inaccuracies and exaggerations of which it was so full; but wishing to verify one or two points of detail which had already appeared in public documents, he wrote to Admiral Capps requesting an interview, and in reply received the following under date of January 8, 1908:

"Yours of the 6th to the Bureau received, and answer has been delayed until to-day on account of inability to see the Secretary of the Navy in relation thereto. On account of the very official turn matters have recently taken, and considering the fact that the Bureaus of the Department directly concerned are preparing exact data concerning various points raised, it is considered inadvisable to furnish specific information, other than that already published, prior to submitting the full report to the Secretary. I hardly think it will be worth your while to come to Washington, since, for the reason stated, I should prefer not to go into these matters in detail until the Secretary has been furnished with the report that is being prepared. He will doubtless be quite willing to release, shortly after its receipt, the non-confidential portions for the better information of the technical press."

Failing to receive this document (through an oversight, as we have since learned) the Editor wrote the following letter to the Secretary of the Navy, under date of February 18, 1908:

"We were greatly surprised and disappointed to find that although copies of the 'Statement Regarding Criticisms of the Navy' by Rear-Admiral Converse had been sent to the daily press, the SCIENTIFIC AMERICAN received no such copy. Although it is a fact that our recent defense of the navy along lines very similar to those followed in this Statement referred to was written entirely upon its merits and upon our strong conviction of the excellence of our ships, we cannot but feel that we should have been among the first to receive a document of this kind."

* * * * * *

Returning to Mr. Reuterdahl's letter, we find that it once more becomes necessary for us to set him right upon several points upon which he has fallen sadly into error. Taking exception to our statement, that our armor belts are in the same position with regard to the waterline as those of British ships, he says: "The British ships have uniform high armor belts extending from 5 to 7 feet below the water to from 7 to 10 feet above." At the risk of repetition (for these facts were all clearly brought out in our refutation of Mr. Reuterdahl's original article) we point out that our ships of the "Maine" and all later classes have lofty side armor, whose *least thickness* is equal to the thickness of the belts of many of the British battleships, and extends from 4 feet below to 19 feet above the water, as against the 7 to 10 feet above, credited to the British ships; while, as an additional protection, this side armor is thickened to 11 inches over the lower 7½ feet of its depth. In the "Connecticut" class the side armor, including the belt, has a least thickness of 7 inches over a width of 24 feet; and on the "South Carolina" and "Dakota" classes, a least thickness of 8 inches over a width of 15½ feet. Against this we have the statement of the former Chief Constructor of the British navy that whereas at full load, the American ships show from 6 to 9 inches of the thick belt above the water, the "Dreadnought" under the same conditions has its corresponding belt from a foot to a foot and a half below the water.

In his reference to the height of broadside guns above the water, Mr. Reuterdahl falls again into his usual error of comparing ships not of the same date, and takes for comparison the British battleship "Lord Nelson" and, presumably, our own "Connecticut." Now, the "Connecticut" was laid down on March 10, 1903, or before the events of the Japanese war had taught the comparative inefficiency of broadside secondary battery guns. The "Lord Nelson," on the other hand, was not laid down until November, 1904, or after the great naval battle of August 10 had been fought outside of Port Arthur. Consequently, the lessons of that fight and of the battle of Tsushima were available before the construction of the ship had advanced beyond a point where they could modify the design. A fair comparison of height of guns would be one between the broadside guns of the "Connecticut" and those of the "King Edward" class; and here we find that, compared on the same basis of flotation, the British guns are 2 feet 3 inches lower than those of our ships, and not as Mr. Reuterdahl states, "twice as high." In all of our ships designed since the Japanese war, the big gun, carried upon the upper deck, has been adopted exclusively as the main armament.

Mr. Reuterdahl objects to our statement that a majority of the French-type ships, with high freeboard and lofty guns, capsized at the battle of Tsushima, stating that they were sunk by gun fire. We entirely agree with Mr. Reuterdahl that the ships were sunk by gun fire; but the point that we make is that the perforation by gun fire of the waterline area of ships which, because of their excessively lofty weights, were inherently unstable, caused them quickly to lose their stability and turn turtle, whereas the other Russian ships, of moderate freeboard and with guns carried at a reasonable elevation, did not capsize, but because of their superior margin of stability were able to remain much longer on a fairly even keel. It is a fact that the majority of the observers, including Russian officers whom we have talked with, who have spoken or written about this fight, agree that most of the French-type vessels did capsize, and that they sank much sooner than they would have done if they had been properly designed.

Mr. Reuterdahl characterizes as "deliberately misleading" our statement that "the one French-type ship, the 'Orel,' which was captured by the Japanese, was changed by them to the 'American type,' by cutting down her decks and lowering her gun positions." The best answer that we can make to this imputation of dishonest motive is to quote directly from the letter of the Japanese official who furnished us with the photograph of the "Orel" published in the SCIENTIFIC AMERICAN of April 4, 1908. "Being of the 'Borodino'" (French) "type as stated above," he writes, "her freeboard was very high, with enormous, towering, unprotected superstructure, *thus greatly increasing the instability of the ship*" (the italics are ours) "and forming a large and prominent target for the enemy's fire. *All these defects inherent in the type have been removed in the renovated 'Orel.'* The 'Iwami' ('Orel') is not only greatly improved in point of stability, but also is no longer, with her considerably lower freeboard, exposed so much to the fire of an enemy." Our Japanese correspondent will learn with no little astonishment that he has been guilty in these statements of "a complete inversion of the truth"; and this upon no less august an authority than that of the gentleman whom the New York Sun indorses as that "very vigorous and useful critic of naval things, Mr. Henry Reuterdahl." Mr. Reuterdahl denies, furthermore, that

(*Continued on page 310.*)

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

The most interesting object in the evening skies this month, for the amateur observer, is the planet Venus, which, from a combination of causes, is unusually conspicuous.

In the first place, she is at her greatest apparent distance (or, as it is technically called, elongation) east of the sun, just before the month begins, so that the interval between the sun's passage across the meridian (at noon) and the planet's is the greatest possible. Moreover, she is also as far north in the sky as she can possibly get, and this makes the interval between her meridian passage and her setting correspondingly long. Both effects reach their maximum on the 6th of May, when Venus is due south at 3:07 P. M. and, being 27 deg. north of the equator, she does not set (for the latitude of Philadelphia) until 7 hours and 41 minutes later; that is, at 10:48 P. M. On the same date the sun sets at 6:54, so that Venus remains in sight for nearly four hours after sunset.

These favorable conditions always present themselves in a greater or less degree when a planet is "evening star" in the spring. A "morning star" at the same season is south of the sun, and much less conspicuous, if at the same distance from him. In autumn, the situation is reversed, and a "morning star" can be seen to better advantage than an "evening star."

In the present instance, Venus is exceptionally well placed, and she is in addition close to her greatest brightness.

The apparent brightness of the planets depends on several factors—their distance from the sun, which determines the intensity with which their surfaces are illuminated; their distance from the earth; and the phase under which they appear. In the case of Venus, whose orbit is nearly circular, the last two factors alone are important, and these work in opposite directions.

She is farthest from us at superior conjunction, when she is almost behind the sun, but at this time she appears to us like a full moon, so that we get the benefit of the light reflected from the whole disk. As she comes nearer to us, her apparent diameter increases, but her phase changes from the full to the half moon, and finally to a crescent. At first the gain in her light due to her increased size more than makes up for the loss due to phase, but finally, when she appears as a rather broad crescent, like the moon about five days old, the loss balances the gain, and after this her brightness begins to decrease slowly at first and then very rapidly as she becomes a narrow crescent.

The lines of her greatest brightness are much nearer her inferior conjunction, when she passes this side of the sun, than her superior conjunction, when she goes behind him, being about 36 days from the former and 256 from the latter. The exact intervals vary a little, because the orbits of Venus and the earth are not exactly circular.

The date of her greatest brilliancy this time is May 29, but she is very bright all through the month, not changing enough to be perceptible except by careful measurements.

All through the present month she is four times as bright as Jupiter at his best, ten times as bright as Sirius, and 100 times as bright as a standard first magnitude star like Aldebaran. There is not the slightest difficulty in seeing the shadows cast by her light, especially in a dark room, where the planet shines through a window and there are no artificial lights to disturb the observations.

It is perfectly easy, in fact, to see her in broad daylight, if only the sky is really clear; but it is hard work to find such a tiny point of light in the broad, blue expanse. When the moon is near by she serves as a guide, but no favorable opportunity of the sort occurs this month.

THE HEAVENS.

Our map makes it easy to pick out the principal constellations. Our old friends, Canis Minor, Gemini, and Auriga, are now low in the west and northwest. Above the former is Cancer (now containing the brilliant planet Jupiter) and higher still is Leo.

The long line of Hydra may be traced across the sky from southwest to southeast. Above it are the small groups of Crater and Corvus, and the important constellation Virgo. The cluster of Coma Berenicis is right overhead, and on the east is Boötes with the great red star Arcturus. Between this and Vega (which has just risen in the northeast) are the Northern Crown and Hercules. Ophiuchus and Serpens have partly risen in the east, and Libra and part of Scorpio are seen in the southeast.

The Great Bear is very high, almost overhead. Draco lies below it, and next is the Little Bear, while Cepheus and Cassiopeia are low on the northern horizon.

THE PLANETS.

Mercury is morning star until the 7th, and evening star afterward. At first he is unobservable, but in the last week of May he may be easily seen, as he does not set till nearly 9 P. M. He is moving rapidly eastward through Taurus and Gemini, and is much brighter than any stars near his path.

Venus is evening star and is exceptionally conspicuous, as we have already mentioned. Mars likewise is evening star, in Taurus and Gemini, and sets at about 9:30 P. M. in the middle of the month. He is far fainter than Mercury, not to mention Venus, being not much brighter than the Pole star.

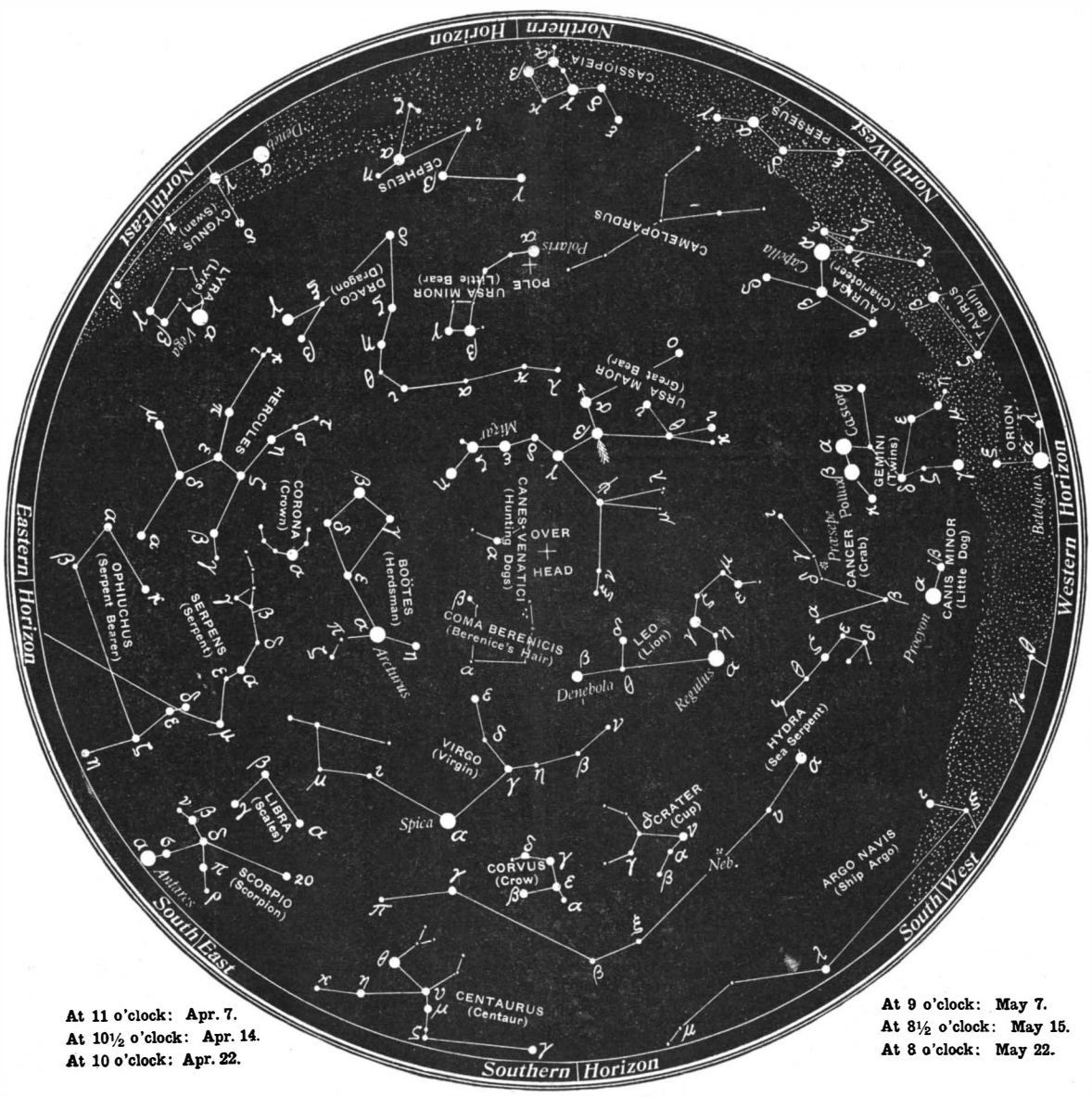
Jupiter again is evening star, but is farther east than the others, in Cancer, and does not set till a little after midnight on the 15th.

Saturn is morning star in Pisces, rising between 2 and 3 A. M. Uranus, which is in Sagittarius, comes to the meridian at about the same time. Neptune is in Gemini, not far from Venus (with which he is in conjunction on the 21st) and is observable in the early evening.

THE MOON.

First quarter occurs at 6 A. M. on the 8th, full moon at 11 P. M. on the 15th, last quarter at 7 P. M. on the 22d, and new moon at 10 P. M. on the 29th. The moon is nearest us on the 20th, and farthest away on the 8th. She is in conjunction with Mars on the 3d, Venus on the 4th, Neptune on the 5th, Jupiter on the 7th, Uranus on the 19th, Saturn on the 25th, and Mercury on the 31st, about 9 P. M. The last is the only conjunction visible from our part of the world.

Princeton University Observatory.



At 11 o'clock: Apr. 7.
At 10½ o'clock: Apr. 14.
At 10 o'clock: Apr. 22.

At 9½ o'clock: April 30.

At 9 o'clock: May 7.
At 8½ o'clock: May 15.
At 8 o'clock: May 22.

NIGHT SKY: APRIL AND MAY

ERECTING THE FIRST CORED MONOLITH.

One of the several new things in construction which San Francisco has done since the city began to rebuild itself after the earthquake and fire of April, 1906, has been to place in position the first cored monolithic column ever used in a building in any city. Many large granite columns have been placed over steel uprights in New York and elsewhere, but they have not been monolithic.

Until the San Francisco innovation the method has been to saw the granite columns on a vertical cross-section and to cement them with marble workers' wax after they have been placed in position. It is probable that the new idea in stone construction, now that it has been successfully carried out, will be extensively followed.

The cored monolithic columns are at the main entrance of the building of the First Federal Trust Company, at the corner of Post and Montgomery Streets, San Francisco. The weight of the columns is not remarkable, many heavier ones having been placed in position in other cities, but the fact that there is a large core through the center of each rendered them very fragile and they had to be handled with the utmost care.

Nearly every contractor who was approached by the architects reported against the plan to erect a cored monolith instead of a column built up in sections. Some of the contractors who were asked to bid on the work demanded as much as $9,000 bonus as an insurance against accident in handling the monoliths.

Finally one of the contractors agreed to take the work and assume the risk without a bonus. The architects insisted that the grain of the monoliths should be the same when standing in the building as in the natural state. In other words, it was made a condition that the columns should be cut from vertical sections in the quarry and not from horizontal sections. There are said to be few granite quarries in the world outside of California where a bed of sufficient thickness could be found to permit of cutting the 21-foot columns from vertical sections.

There are four columns in all, and they were cut out in two sections, two columns to the section. Before cutting and coring the columns they weighed forty-six tons each, and afterward only twelve tons, which gives an indication of the amount of work which was done on them. It was necessary to bore more than 300 linear feet of holes in each column in order to take out the cores. This work had to be done with great accuracy, as it was essential that the monoliths should retain a perfectly vertical position after they had been fitted closely over the steel columns.

The columns were removed from the quarry at Raymond to San Francisco on a special train, the crew of which had received instructions from the Southern Pacific Railroad Company to proceed at slow speed and with great care in starting and stopping the train.

The columns were raised from a horizontal to a vertical position with rope swings. In the bottom of each column, shoulders had been cut, and into these had been set iron bars, to which were attached the clevises. The columns were hoisted to a height of more than fifty feet and were slipped over the steel columns which were standing to receive them. After the weight had been released from the cable the clevises detached themselves and the cables were hauled out.

The Italian State Railway authorities in Rome have just placed orders for 331 new locomotives, 215 being divided among five Italian builders and 116 between three German concerns.

THE STOCK CAR RACE FOR THE BRIARCLIFF TROPHY.

The second automobile race for stock touring car chassis to be held in America this year took place on a rough, sinuous, and hilly 30-mile course in Westchester County, April 24. The course was an extremely difficult one, there being in the neighborhood of seventy sharp turns per circuit. A control 2.8 miles in length was located in the village of Mount Kisco, and this gave the drivers a short respite once in every circuit. The total distance around the course was a trifle over 32.4 miles, and, with the control deducted, the racing distance per circuit was therefore 29.6 miles. As eight laps were made, the total distance covered was 236.8 miles.

The race was for stock touring car chassis, the engines of which had a total piston area of not over 103.87 square inches. Most of these engines were rated at from 30 to 45 horse-power, although some of them ran as high as 60. No car could be entered in the race unless it was shown that the manufacturer had built ten similar touring cars.

The American and foreign cars entered were equally divided, there being eleven of each. The former consisted of one Apperson, one Allen-Kingston, one Hol-Tan-Shawmut, one Thomas, two Lozier, two Simplex, and three Stearns machines; while the foreign cars were one Austrian Maja, one German Benz, three French cars (two Renaults and one Panhard), and six Italian cars (a Bianchi, two Fiats, and three Isotta-Franchinis). Of the foreign cars, the Isottas and the Fiats were the favorites, as these had 50 and 60 horse-power engines respectively, and as they had performed excellently in the previous race at Savannah. Of the American machines, a 50-horse-power Apperson, driven by Herbert Lytle, the 30-horse-power Stearns cars driven by Guy Vaughan, F. W. Leland, and Barney Oldfield, and the 45-horse-power Lozier cars driven by Michener and Mulford, were the favorites on account of their powerful motors and because, piloted by various of these men, they had done well in other racing contests.

The first car was started at 5:07 A. M., and the others followed at one-minute intervals. The No. 4 Isotta car, driven by Louis Strang, was pushed as fast as possible from the start, the result being that before he had finished the first lap, he passed the three cars that started before him—Sartori's No. 1 Bianchi, Cedrino's No. 2 Fiat, and Lytle's No. 3 Apperson. He completed the lap in 39 minutes and 42 seconds. Less than 2 seconds after he passed the grand stand Lytle rushed by, followed at a distance of several hundred yards by Sartori. There was a sharp turn a short distance before the grand stand was reached. In making this turn the Bianchi swerved and made a dangerous skid, so that for an instant it was turned almost across the road. Sartori managed to right the machine again, however, after which he pulled up at the side of the road to replace a burst tire. While a new tire was being fitted, Cedrino's Fiat and Leland's Stearns passed by. Guy Vaughan's Stearns also passed less than 2 minutes after Leland. Then came Michener in the No. 7 Lozier car, one of the tires of which burst in front of the grand stand. The second Lozier followed a moment after.

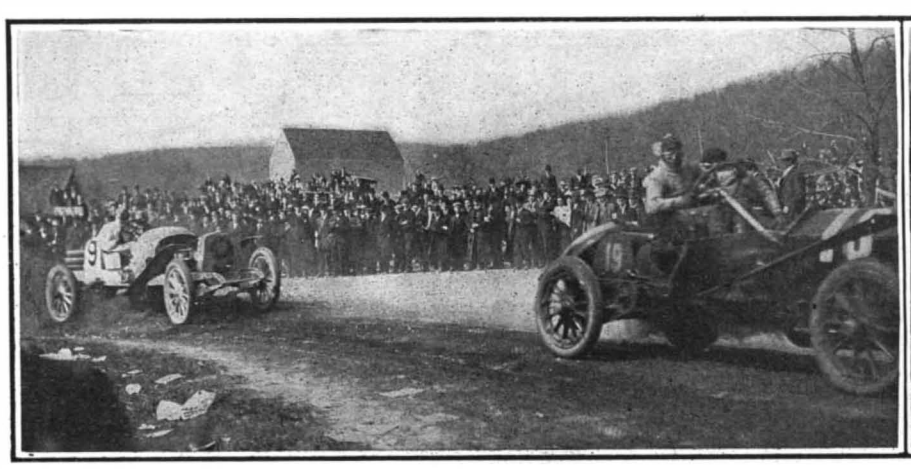
The only car to meet with a serious accident during the first round was the 50-horse-power Simplex No. 22, driven by William Watson. In making the sharp turn near Eastview, this machine skidded, struck a post, and turned upside down. The driver and his mechanic were both thrown out, but neither of them was seriously injured. The car was righted, and in about an hour it was once more running in the race. It was on its fifth lap when the race was called.

The leader Strang made his second round in 38:23, or 1 minute 19 seconds faster than his first lap. His car was running splendidly. He was closely followed by Lytle in the 50-horse-power Apperson, and was but 3 minutes and 42 seconds in the lead, while but 40 seconds separated Lytle and Vaughan's No. 8 Stearns car, while Cedrino was 2 minutes and 37 seconds behind.

At the end of the third round the Stearns had moved up to second place, and was 4 minutes and 47 seconds behind Strang and 1 minute 38 seconds ahead of Lytle, while Cedrino was 1 minute and 25 seconds behind the latter. When the race was half over the Stearns car was still second, but it was only 53 seconds ahead of the Apperson, while the leading Isotta was 10 minutes and 4 seconds ahead of it. Cedrino was in fourth place, 3½ minutes behind the Stearns. At the end of the fifth lap the Apperson car had again moved up to second place, though it was but 21 seconds in advance of the Stearns car, while the Isotta was 12 minutes and 55 seconds ahead of it. Cedrino completed this lap in 39:35. His first four laps had been run very cautiously, none of them in less than 40 minutes, but he now set out to make up for lost time, and each of his remaining laps was faster than the one before. At the end of the fifth lap he was but 1 minute and 36 seconds behind the Stearns, while at the end of the sixth lap he had reduced the latter's lead to but 14 seconds. At this time the Stearns had again crept up to second place, so Cedrino was running third, and Lytle fourth, 1 minute and 10 seconds after the Italian. Strang was at this time 11 minutes and 43 seconds ahead of the Stearns car. At the end of the seventh lap Cedrino, because of the fast time he had been making, passed the Stearns and was running in second place, 10½ minutes behind Strang. The Apperson car also had passed the Stearns and was 2 minutes and 3 seconds in advance of it, while the time which separated this car and the Fiat was 3 minutes and 19 seconds. As the last lap was one of Strang's slowest, and as it was also Cedrino's fastest, the latter succeeded in gaining 3 minutes 37 4-5 seconds over the former, and consequently he was beaten by but 6 minutes 52 1-5 seconds. He was followed 7 minutes and 24 seconds later by the Stearns car, which again passed the Apperson and succeeded in beating it by 10¾ minutes. The 50-horse-power Italian Bianchi, the only other car to finish, obtained fifth place. Cedrino made the last round in 36 minutes 48 3-5 seconds. This, the fastest round made by any car in the race, is equivalent to a speed of 48.24 miles an hour.

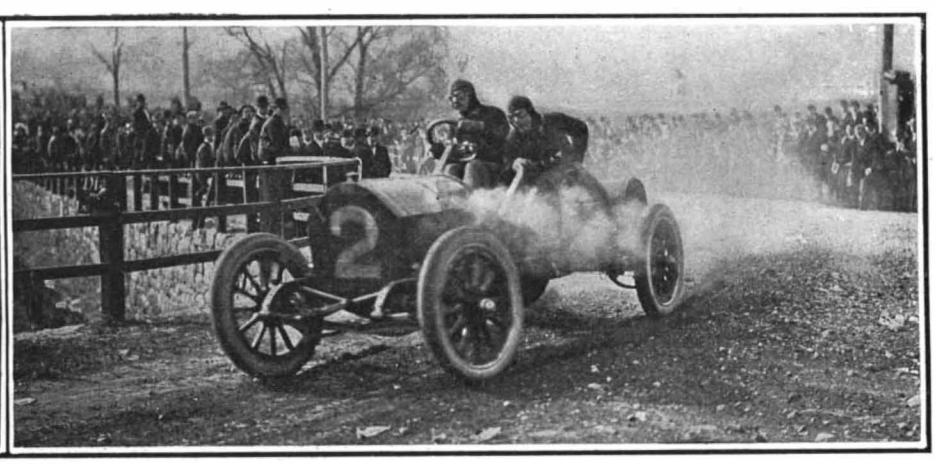
The times and speeds of the winning cars in this 236.8-mile race were as follows: First, No. 4 Isotta-Franchini, driven by Strang, 5:14:13 1-5, which is a rate of 45.22 miles an hour. Second, No. 2 Fiat, driven by Cedrino, 5:21:05 2-5, which is a rate of 44.25 miles an hour. Third, No. 8 Stearns, driven by Vaughan, 5:28:29 2-5, which is a rate of 43.25 miles an hour. Fourth, No. 3 Apperson, driven by Lytle, 5:39:15 2-5. Fifth, No. 1 Bianchi, driven by Sartori, 5:53:45 3-5.

From the above figures it can be seen that the times compare very favorably with those made in the recent



A Lozier Car Attempting to Pass an Isotta-Franchini at One of the Turns.

Two Lozier and three Isotta machines took part in the race.



The Fiat Car Making a Turn. This Car Won Second Place.

Time, 5 hours, 21 minutes, 5⅖ seconds. Average speed, 44¼ miles an hour.

View Showing an Isotta Car Descending Sharp Grade Near Eastview.

The Maja car broke a wheel in passing another car at bottom of this hill.

The Winning Isotta-Franchini Car, Driven by Strang, Finishing.

Time, 5 hours, 14 minutes, 13⅕ seconds. Average speed, 45.23 miles an hour.

Savannah race, although the course in this instance was a much more difficult one. Some idea of the hills and sharp turns that were encountered can be had from the photographs which we reproduce. The race was a very thorough test of all the cars entered, and it is gratifying to note that none of the American cars developed any structural weaknesses. The Austrian machine had a front wheel collapse at one of the turns, owing to the great side strain put upon it in trying to make a sharp turn on a sandy stretch of road when passing another car. One of the Fiat cars dropped out on account of engine trouble, but this was the only machine that had trouble of this kind. Two American machines, an Allen-Kingston and a Lozier, were ditched, thus effectually putting them out of the race; but with these four exceptions all the cars were running when the race was called off. As is usual in these road races, there was a great deal of trouble from spectators crowding on the course. The fact that a large number of militia policed the course did not make much difference. In the vicinity of the grand stand one spectator was struck and had his leg broken. On the whole, however, the race was run without accident, and the times were remarkably good in view of the crowding of the spectators upon the course. There is but little doubt that such a stock car race will become an annual event, and that considerable improvement of the machines will result therefrom.

HOW STEREOSCOPIC EFFECTS MAY BE PRODUCED WITH A PINHOLE DIAPHRAGM.

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

In a previous article the writer has shown that strong monocular relief could be had with a geometrical drawing when several artifices were used simultaneously to deceive the eye. He has found, since, that whenever the most important of these factors, i.e., positive distortion and exaggerated curvature of the focal surface, were set at work, monocular relief could be obtained, not only with a geometrical drawing, but even in the case of ordinary pictures.

Examined through a pinhole, at a distance of about one inch from the eye, a geometrical drawing like Fig. 1 stands out in clear and strong relief. The distortion which causes the illusion in this case has been produced by two different methods. One process, which might be called artificial distortion, gradually modifies the shape of the little black and white squares as they get farther and farther from the center of the figure. The second kind of distortion, which the writer calls "diaphragm distortion," for lack of a better name, is the result of the position of the pinhole before the eye and at some distance from it. Diaphragm distortion acts as artificial distortion does in the bending of straight lines and in decreasing the scale of reproduction from the center to the periphery, but this gradual change in the scale of reproduction is not confined to the geometrical figures, it affects the very grain of the paper. Moreover, an extreme curvature of the focal surface is the result of the position of the object close to the eye, while the small diaphragm permits the perception of a distinct image notwithstanding this adverse circumstance. The central parts of the figure are comparatively near the principal focus of the eye; the rays they emit meet far behind the retina; the image is large, and gives therefore the impression of being produced by an object placed near the eye. The marginal parts of the drawing are relatively much farther from the eye; their image is not formed so far behind the retina; it is smaller than that of the central parts, and seems to be produced by some far-away object.

Both artificial and diaphragm distortion are brought into play for the production of the relief illusion, which becomes evident when the head shown in Fig. 2 is viewed through a pinhole at a distance of about one inch from the eye. Artificial distortion could not be produced in that case as in a geometrical drawing, but the photograph was made with a short-focus lens, diaphragm before the lens, and some positive distortion of the features was the result. When the same process was applied to the reproduction of objects which were not more or less spherical, it was found deficient. The relief on the picture was doubtful or intermittent. Distortion might have been increased with a suitable combination of objective and lens, but good results were obtained by making a photograph of the object viewed in a spherical convex mirror. The camera shown in Fig. 3 was photographed in the mirror while at work taking its own picture. The pinhole relief illusion is strong enough, especially when the protruding bed of the camera is examined, yet neither in this nor in the case of the head can the relief be compared with that in which artificial distortion of geometrical figures is brought into play. An accurate idea of the deceiving power exerted on the eye by the latter kind of distortion can be had when Fig. 4 is examined through a pinhole at the distance of about one inch from the eye. While the peripheral ring literally bulges out of the paper, the central disk gives the illusion of a shallow depression. Diaphragm distortion is

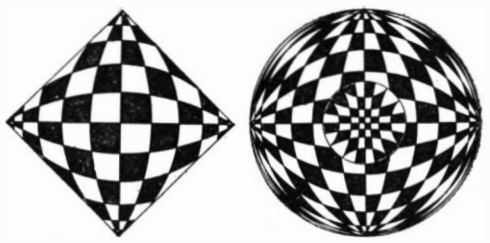


Fig. 1. Fig. 4.

Artificial Distortion of Geometrical Figures.

abruptly and completely counteracted by negative artificial distortion resulting from the peculiar alteration in the shape of the little black and white squares on the central disk.

According to the principles which have just been stated, stereoscopic effects ought to be perceived without a diaphragm, as the pupil may take the place of the pinhole. The position and aperture of the pupil, however, are not such as to produce a strong relief illusion, and objects cannot be brought very near the eye without being blurred; yet if artificial distortion is added, stereoscopic relief will be readily perceived.

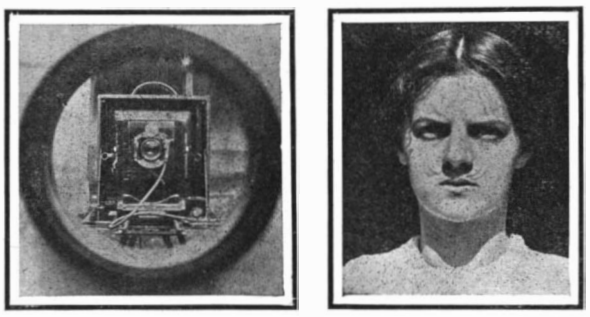


Fig. 3. Fig. 2.

Illustrations of Artificial and Diaphragm Distortion.

The accompanying drawing (Fig. 5) should be examined with an eye placed right above the center of the figure and about two or three inches away. The other eye should be closed. As soon as it is open, the relief illusion, although strong, at once vanishes.

Anode Rays and Canal Rays.

[Gehrke and Reichenheim have recently discovered that anodes composed of certain substances emit positively electrified "rays," or streams of particles.] These true anode rays are quite distinct from the positive anti-cathode or canal rays discovered by Goldstein in 1886, which appear at the outer side of a perforated cathode—that is, at the side which is turned away from the anode. The canal rays move outward, or in a direction opposite to that of the cathode rays, which are emitted by the inner side of the cathode. Like the cathode rays, they excite fluorescence in various substances, and their path can be traced by this means. They are deflected by magnetic and electrical forces, the deviation being, on the whole, opposite to that experienced by the negative cathode rays. Hence it is inferred that the canal rays are streams of positively electrified particles. The velocities and masses of the particles can also be deduced from the magnetic and electric deflections. In this way it is found that the velocity is very much smaller and the mass very much greater than those of the negative electrons which constitute the cathode rays. In the language of the electronic theory, the canal particles are positive ions, that is to say, material atoms which have become positively electrified through the loss of some of their (negative) electrons.

But the electrical charge of the canal particles is not uniform. W. Wien and, more recently, J. J. Thomson have succeeded in separating the beam of canal rays, by the simultaneous action of magnetic and electrical forces, into three portions, of which two are deflected in opposite directions and the third pursues its original course. The inference is that the rays contain particles of three kinds—positive, negative, and neutral, or unelectrified. Thomson, however, makes the plausible supposition that all the particles are positive at the outset, but the charges of some of them become neutralized and those of others reversed by their passage through the swarm of negative electrons about the cathode.

It has been proven that the canal rays are not emitted by the anode, as their preponderatingly positive charge would suggest, but originate in the luminous envelope of the cathode, where the molecules of the residual gas are ionized by collision with the negative electrons emitted by the cathode. In these collisions the molecules and atoms are disintegrated in an explosive manner, with the production of light and the separation of negative electrons which join the stream of electrons emitted by the cathode. The remnants of the atoms—the positive ions—are attracted by the cathode, which arrests some of them, while others pass through the holes (or canals) in the cathode in virtue of their acquired momentum, and form the canal rays.

The true anode rays which were recently discovered by Gehrke and Reichenheim were first observed in an evacuated tube with a cathode of platinum foil and an anode of platinum wire, which were connected with the poles of a static electric machine while the cathode was heated to incandescence by an electric current. The cathode emitted cathode rays of the usual character, and a glow like the flame of a torch appeared at the anode, but rapidly faded away.] The evanescent character of the phenomenon suggested that it was due to a slight impurity on the platinum wire which was gradually driven off as the discharge continued. Other physicists had made the same observation, but had not followed it up. [Gehrke and Reichenheim, on the contrary, investigated the phenomenon and discovered the anode rays.] The conjecture that the rays originated in a trace of impurity on the platinum wire was soon confirmed by the production of a more intense and persistent emission of rays from anodes formed of cylinders of various salts or platinum cups filled with those salts. Such anodes emitted brilliant luminous pencils of the colors which the salts employed communicate to the flame of a Bunsen burner. The most striking effects were obtained with salts of sodium and lithium.

The luminosity of the beam of anode rays is greatest in comparatively low vacua. As the exhaustion is increased the rays become less bright, but the opposite wall of the tube on which they impinge begins to glow with the same color. The deflection caused by magnetic and electrical forces can be studied by means of the displacement of this luminous spot on the glass. Thus it has been found that the anode rays are composed of positive ions, or particles of atomic magnitude, and are essentially similar to the canal rays and the α rays of radioactive substances.

The failure of earlier attempts to obtain anode rays from metallic anodes is easily explained by the insufficiency of the electromotive force to disrupt metals. In a fused mass of salt some of the molecules are already dissociated into oppositely charged ions and a small electromotive force suffices to detach the positive ions, or modified atoms of sodium, lithium, etc., and discharge them

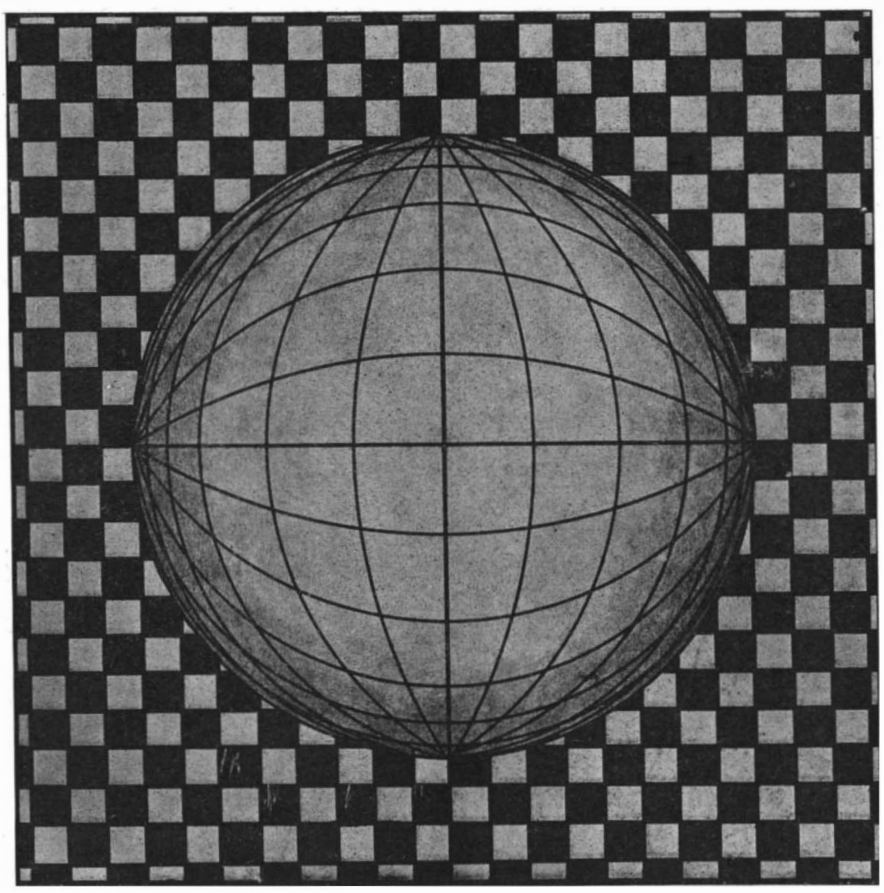


Fig. 5.—Geometrical Figure Which Shows Artificial Distortion Without a Pinhole Diaphragm.

PINHOLE MONOCULAR STEREOSCOPY.

as anode rays. The investigation of the anode rays is still incomplete, but the experiments of Gehrke and Reichenheim have not only filled a puzzling gap in the scheme of the phenomena of electrical discharge in rarefied gases, but have also furnished additional support to the monistic theory, which seeks to explain all electrical phenomena by the assumption of electrons, or atoms of electricity, of one kind only, namely, negative.—Prof. B. Dessau in Umschau.

A CAMPANILE 700 FEET HIGH.

The majestic steel-and-marble campanile of the Metropolitan Life Insurance Company's building on Madison Square, is climbing skyward at such a rapid rate, that already its topmost floor is about 500 feet above the sidewalk. The excavations for the foundations were commenced late in the autumn of 1906. The erection of the steelwork was begun on February 15, 1907, and the work has progressed so rapidly, that the last piece of steelwork will have been riveted in place, 700 feet above the sidewalk, before the close of the present month. The clothing of the building with its outside wall of Tuckahoe marble will have been completed by the following November; and it is the expectation of the architects that the whole building will be completed, ready for occupancy, by May 1, 1909.

The tower stands at the northwest corner of the Metropolitan Life Building which, including the tower, covers the whole block between Fourth and Madison Avenues and Twenty-third and Twenty-fourth Streets. The main building, which has a frontage of 200 feet by 425 feet, is ten stories in height. It is built in the early Italian renaissance style, the materials of construction being steel and Tuckahoe marble. The campanile is being carried up in the same style and of marble from the same quarries. It stands on a base measuring 75 feet by 85 feet, and the architectural treatment, as will be seen from our engraving on the front page, is chaste, somewhat severe, and eminently agreeable to the stupendous proportions of the structure. The tower conforms in line and detail to the main building as far as the fourth story, above which the treatment is simple, involving three groups of triple windows on each side, with heavily molded and deeply recessed jambs. On each face of the tower, at a height of 324 feet above the sidewalk, and covering the height of over two stories, will be a huge clock, 25 feet 6 inches in diameter on the dial, with figures 4 feet in length and with hands 12 feet in length. Two stories above the clock will be a line of massive projecting balconies, above which will be a series of Ionic loggias, presenting five arched openings on each face of the tower. The height of these loggias, which will be over 50 feet, can be judged from a study of the upper steelwork of the tower, as shown in our engraving; for they will fill the whole height between the heavy trussed girders which extend entirely around the tower below the offset.

The offset has a depth of 8 feet inward from the outer face of the shaft. This offset portion is carried up for four stories and forms the base for a huge pyramidal termination, whose sloping face will be covered with the same pure blue-white marble as the shaft. The pyramid will be crowned by an octagonal colonnaded observatory, also clothed with marble, which will form the highest office floor in the building, at an elevation of 637 feet above the sidewalk. This observatory will be of no small size, consisting of a room 20 feet in diameter lighted by eight 5 x 5-foot round-top windows. The capping of the windows will form the highest point to which the marble finish of the campanile will be carried.

The extreme height at first determined upon for the tower was 658 feet; but revisions have recently been made in the plans, and, as a crowning feature, it has been determined to cap the structure with a lofty observatory and lantern, 50 feet in height, which will be constructed of steel and copper and gilded. The observatory will be reached by a winding staircase from the 637-foot level, and will consist of a balustraded platform at an elevation of 660 feet above the sidewalk. This will be the highest point to which the public will be admitted, and in all conscience it is high enough.

The lantern, 40 feet in height, including its finial, will be one of the designedly spectacular features of this highly spectacular structure. It will be built of steel and copper, with strong glass windows, and it will contain an arc-light of unusual power. It is proposed to use the light for designating the time after nightfall. This will be done by giving one red flash for the quarter, two for the half, and three for the three-quarter hour, and a white flash for the hour. The great power of the light and the vast height at which it is set, will serve to make the tower as conspicuous a landmark at night as it will be by day.

Just what a tower 700 feet high actually means may best be understood when it is remembered that Eagle Rock in the Oranges is 624 feet above tidewater. The top of the Metropolitan tower will be 734 feet above the same level, and hence will overtop Eagle Rock by just 110 feet. What the outlook will be from the 660-foot level may be judged from the accompanying illustrations, showing views of New York city taken from points on the tower fully 200 feet lower than this. Mountain climbers will recall how rapidly the details of the landscape develop with every 100 feet of height that is gained at the higher elevations; and the observer from the topmost lookout will be astonished to find with what maplike precision not only Greater New York, but a wide circumference of the outlying country, is laid out before him.

During a recent inspection of the tower, we were impressed with the fact that, both in the design and the construction, every effort has been made to produce a building that shall be permanent. Liberal allowances have been made in every direction for any possible stresses that may come upon the structure. Collapse either by overturning or bending and breaking has been amply provided against. Bending, or distortion of the building under wind pressure, is prevented by the introduction of unusually heavy knee-braces at the junction of the columns and the floor beams on each floor; and overturning is impossible because of the enormous weight of the tower. The total dead and live load combined amounts at the foot of each of the corner columns to 7,500,000 pounds. When a gale of unusual severity is blowing, it is estimated that its pressure may possibly rise to 30 pounds on every square foot of exposed surface. The effect of this on the face of the tower would be to press down the leeward side and tend to lift up the windward side. The added downward pressure brings the total load on the leeward corner columns to 10,400,000 pounds, while at the same time the corresponding columns on the windward side, because of this uplift tendency, are relieved of pressure so that the total vertical pressure is reduced from 7,500,000 to 4,600,000 pounds. It is evident then that as long as the windward columns are bearing upon their foundations, even during a heavy gale, with a pressure of 2,300 tons, the tower is absolutely safe against overturning. The lower sections of these corner columns are very massive, being about 2 feet square, weighing over 1 ton to the lineal foot, and containing 528½ inches of section.

But however heavily and strongly this great campanile may be built, it is certain that, if its steelwork be not protected against the insidious effects of oxidation or rusting, it will only be a question of time before it will crumble into a shapeless ruin. To preserve the steelwork, special precautions have been taken. It is first treated to a priming coat of cement paint. When the steel is delivered at the building, the contract calls for careful repainting of all the edges and all abraded surfaces. After erection, the steel is treated to a heavy coat of waterproof paint. When this is dry, strap-iron is wrapped around the columns, the knee braces, and the exposed portions of the floor beams, and a thick envelope, consisting of three of sand to one of cement, is poured in between the inclosing wooden forms and the steel and very carefully rammed in place. This cement envelope extends 2 inches outside the widest diameter of the steel members, and fills in all the interstices, adhering closely to every square inch of surface. Thus the steel framework is absolutely protected against fire (which in a building of this kind is not a serious risk); but what is more important, rusting, the only form of decay to which the building could possibly be subjected, is prevented for all time. The floors of the building are filled in with arched concrete and finished with a granolithic surface, and thus from foundation to summit the tower is built of materials which are indestructible as far as human knowledge goes. Its life should be as long and longer than that of the Pyramids themselves; for the experience with steel and masonry buildings of inferior construction in San Francisco has shown that beyond stripping the stonework from the walls, a severe earthquake works no great injury to a structure of this kind.

The tower will be served by six elevators, which will be express to the twelfth floor. From the twelfth to the twenty-fifth floor three of them will be local and three express; while two elevators will run from the twenty-fifth to the forty-second floor and one to the forty-fourth floor.

But if anyone prefers walking to taking the elevator he can gain the 660-foot lookout by walking up 1,057 steps!

Increase in Coal-Mine Deaths.

According to J. A. Holmes, chief of the technologic branch of the United States Geological Survey, reports regarding coal-mine accidents of 1907 show an increase of about 50 per cent in the number of men killed as compared with 1906. From the information already received, Mr. Holmes says:

"It seems probable that an increase of 25 per cent in the number of fatal accidents will be shown for the year 1907 over the figures for 1906, without taking into consideration the disasters of last December, in which 694 men were killed. Counting the big disasters, the deaths will be more than 3,000, which will be a 50 per cent increase over the year 1906. The figures regarding injuries, as far as received, show an increase of more than 57 per cent in the number of men injured."

THE SENATE, THE SCIENTIFIC AMERICAN, AND THE NEW YORK SUN.

(*Concluded from page 306.*)

gun positions were lowered on the "Orel," for the reasons that we gave. To convince him of his error, we ask him to refer to the photograph of the reconstructed "Orel" published in our journal, which shows that of the original secondary battery of twelve 6-inch guns, eight were carried in four armored turrets on the spar deck at an elevation of about 32 feet above the water; that these four turrets with their eight guns and the whole of the midship portion of this spar deck have been entirely removed; and that the places of these guns have been taken by four 8-inch guns mounted, not at the former height, where Mr. Reuterdahl to be consistent should place them, but on the main deck, behind light shields, at an elevation 8 feet nearer the waterline.

"Finally," says Mr. Reuterdahl, "as an example of direct and inexcusable misstatement of facts there is the astonishing assertion that 'the open ammunition hoist to the turrets is not peculiar to our own navy, but is found in several of the crack battleships and cruisers of other navies.' There is not now, and never has been an open ammunition hoist to any foreign turret. All foreign hoists of whatever type are so devised as to separate the turrets completely from the magazine." In answer to this it is sufficient to say that in the course of a recent conversation with Sir William White, that eminent authority informed the Editor of the Scientific American that he was himself the original designer of the interrupted hoist (the type which Mr. Reuterdahl would have us install in our ships); that he made this design some twenty years ago, not because it was safer, but because it was more rapid; and that so far from the direct or open hoist being peculiar to our navy, it is to be found on the majority of the armored ships of the navies of the world that are to-day afloat and on the active list. Mr. Reuterdahl will find it, for instance, on the battleships "Glory," "Albion," "Triumph," and "Swiftsure," and on most of the British armored cruisers.

We quite agree with Mr. Reuterdahl in his conviction that "Mr. Hale is well acquainted with all of the above details"; and we dare to hope that after the enlightenment which it is now, for the second time during the past few months, our privilege to afford Mr. Reuterdahl on matters in which he is commendably interested, he will agree with us that "the editorial from the Scientific American which Senator Hale has inserted in the Record as a hearing, is eminently qualified to" direct and not "mislead public opinion."

The Current Supplement.

The current Supplement, No. 1687, contains an unusual variety of interesting articles. Mr. J. B. Van Brussel writes on European armor and its attack, dilating chiefly on modern Krupp armor. The United States Geological Survey recently made some comparative tests of alcohol and gasoline. The results of these tests are published. The second part of Prof. Watson's admirable discussion of alternating-current motors (constituting the sixteenth installment of his "Elements of Electric Engineering") likewise finds a place in the Supplement. Mr. Chapman Jones's excellent review of the present state of the art of colored photography is concluded. There was recently opened in London a novel weather observatory, which is packed, not with instruments, but with tropical plants which have the remarkable property of responding to electrical and magnetic influences. By means of these plants the director of the observatory hopes to foretell the weather with considerable accuracy. The observatory and the plant are fully described by Harold J. Shepstone. In an admirable paper entitled "Interrelations of the Elements" Prof. Herbert N. M'Coy summarizes recent radio-active investigations. Mr. C. C. Crossley writes on a new method of concrete construction for small dwelling houses. Abbé Moreux writes on the latest work on the solar parallax. "Genesis of the Formation of Mineral Veins" is the title of an instructive paper by Dr. W. E. Everette, in which he discusses the analytical composition of the rocks of the earth and the metals extracted from the rocks.

The Japan Financial and Economic Monthly for December states that with a view to facilitate the irrigation of the island of Formosa and to give an electric supply, the Formosan governor-general has planned an irrigation work on a great scale, and in order to bring it into practice, the authorities concerned at present are negotiating with the department of finance. According to the investigation made by the governor-general, the total outlay for construction would amount to 30,000,000 yen. The work is to be completed in sixteen years.

Correspondence.

More Curiosities of Numbers.

To the Editor of the SCIENTIFIC AMERICAN:

Your article in this week's issue concerning the mysterious properties of certain numbers is so interesting and suggestive, that I am led to contribute a few more wonders in the same line, which I think may interest your readers. It is an undoubted fact that there is no more obscure or difficult branch of mathematics than the theory of numbers, and none more fascinating. I shall first consider the properties of groups of numbers in connection with their residuals. Take the following series: 1, 3, 5, 6, 4, 7, taken at random; adding them together, $1 + 3 + 5 + 6 + 4 + 7 = 26$, $2 + 6 = 8$. This figure 8 is the residual root of this group, and is independent of the arrangement of the numbers in forming an addition; e. g. arrange them as follows:

$$\begin{array}{rr} 135 & 1356 \\ 647 & 47 \\ \hline 782 & 1403 \end{array} \quad \text{or}$$

Taking the residuals of the addition, we have:

$7 + 8 + 2 = 17$, $1 + 7 = 8$, and $1 + 4 + 3 = 8$,

which is the same root as obtained in the first instance. This property may be made the basis of a very pretty trick in numbers, as follows: Ask some one to write a string of numbers and show them to you. Then after obtaining the residual root, request that he strike out one of the numbers, and after arranging the remaining digits in any way he pleases in the form of an addition sum, let him add them up and give you the answer. The difference between the two residuals will be the number scratched. If the second root is larger than the first add 9 to the first and then take the difference. For example suppose he writes the following numbers:

1, 3, 5, 6, 8 (residual root = 5).

He scratches out the 3, and then after arranging as follows

$$\begin{array}{r} 15 \\ 68 \\ \hline 83 \end{array}$$

and giving the answer, which is 83, we obtain the residual 2, and this subtracted from the 5 gives 3, which was the number scratched. This is a peculiarly mystifying trick, on account of the multitude of ways in which the remaining figures may be arranged for addition, and wide variation in the resultant summations from which to obtain the residual. In the matter of magic squares, the following species is interesting: Consider the square of any odd number, such as $5^2 = 25$, $7^2 = 49$, or $3^2 = 9$. Let x stand for any one of these numbers; then:

$$\left(\frac{x^2}{2} + \frac{1}{2}\right) \quad x = y$$

which is the amount to which the numbers when arranged in a magic square add up, when summated along any line of squares or along the principal diagonals. For instance, let us take the number 7.

$$\left(\frac{7^2}{2} + \frac{1}{2}\right) 7 = 175$$

Arrange the numbers from 1 to 7 as follows:

30	39	48	1	10	19	28
38	47	7	9	18	27	29
46	6	8	17	26	35	37
5	14	16	25	34	36	45
13	15	24	33	42	44	4
21	23	32	41	43	3	12
22	31	40	49	2	11	20

It will be found that the sum in any direction is 175. The following is for numbers from 1 to 3, adding up 15:

8	1	6
3	5	7
4	9	2

This is obviously the simplest form possible. The law of position involved in these squares is too long and complicated to be gone into at present, but there is no difficulty in forming these squares with any odd number of squares on a side. Lastly, let us discuss a simple and useful method of proving multiplication sums through the elimination of the figure 9. Consider the following:

$$13468 \times 347 = 4673396.$$

To prove this answer, add up the figures of the multiplicand and eliminate the 9's; we obtain the number 4; treat the multiplier in the same fashion, giving 5; multiply these together, and take out the 9's, leaving 2. Now add up the figures of the answer and take out the 9's. If the remainder is 2, the answer is correct; it will be found that it is so. The remarkable part of this process is that the figure 9 need not appear. For instance:

$$111 \times 11 = 1221.$$

To prove, we have according to the rule $3 \times 2 = 6$, which is the sum of the digits in the answer. I should like very much to see an explanation of this remarkable property. ALBERT R. GALLATIN.

New York, March 27, 1908.

Curious Facts About Numbers.

To the Editor of the SCIENTIFIC AMERICAN:

In the latest copy of the SCIENTIFIC AMERICAN (dated March 28) I have read with considerable interest the article headed "Curious Facts About Numbers." The closing portions of that article attracted me especially, inasmuch as some time ago I had arrived at the same conclusion as the author. I refer to the paragraph which shows that the sum of a series of odd numbers beginning with 1 is equal to the square of the number of terms, or the sum of the first n odd numbers is equal to n^2. However, the way that I stated the principle is slightly different from the one given above, and would go like this: To find the sum of a series of odd numbers beginning with 1, square middle term if number of terms is odd. If number of terms is even, square the even number which would stand between the two odd terms in the middle of the series, as for example in the series:

$$1 + 3 + 5 + 7 + 9 = 25.$$

The number of terms is odd, 5 being the middle term, and $5^2 = 25$.

Also take the series

$$1 + 3 + 5 + 7 + 9 + 11 = 36.$$

The number of terms is even, 5 and 7 being the two middle terms, and 6 the even number between these two, and $6^2 = 36$.

While this is essentially the same as that which appears in your paper, your manner of expressing the idea is of course greatly superior. This merely shows that two persons may arrive at the same result by different methods, and with no understanding between them.

And now if you will allow me, I shall describe to you three other facts in relation to numbers which I think may be interesting. We have a formula for the sum of odd numbers beginning with 1, and now the sum of a series of even numbers beginning with 2 may be secured in a somewhat analogous manner. Take the series for example:

$$2 + 4 + 6 + 8 + 10 = 30.$$

The number of terms $= n = 5$, and the sum of the series $= n^2 + n = n\ (n + 1)$. This may be shown to be true for any series of even numbers beginning with 2.

The other two facts which I shall describe have to do with the sum of a series beginning with 1. There are two cases to this problem: (1) When the last term is odd; (2) when the last term is even.

(1) When the last term is odd.

For example, take the series ending with 11. Then we have $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 = 66$. On examination we can show that the sum may be formulated as follows: $s = n$ (number of odd terms).

$$\begin{array}{r} n = \text{last term} = 11 \\ \text{The number of odd terms} = \ 6 \\ \hline s = 66 \end{array}$$

(2) When the last term is even.

Take the series ending with 16. Then we have $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 + 16 = 136$. Now in this case it can be shown that the sum of the series is n (number of even terms) $+ \frac{n}{2}$, in which n is the last term, or 16.

But it may also be shown that the number of even terms is just one-half the last term, or $\frac{n}{2}$. Then the formula is

$$s = n\left(\frac{n}{2}\right) + \frac{n}{2}$$

$$s = \frac{n^2}{2} + \frac{n}{2}$$

$$s = \frac{n^2 + n}{2}$$

$$s = \frac{n\ (n + 1)}{2}$$

These formulæ may be shown to hold true for any series, those given being merely chosen haphazard.

A. A. LAUGHLIN.

Waterford, N. Y., March 29, 1908.

A Defense of Audubon.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 25 you published a letter from a Mr. W. N. Hutt, quoting a most interesting essay on rattlesnakes by the naturalist Audubon, and also remarks thereupon (to which the writer of the letter adds his approval) by the then editor of the Franklin Institute Journal, condemning Audubon in unqualified terms as a "faker," and placing him on the level with Munchausen *et al.*

Will you now allow me, after these preliminary remarks, to say a few words in defense of Audubon's essay, or that part of it which you reproduced? It will be evident from all those who are familiar with our common snakes, that with one exception the naturalist's remarks are absolutely in accord with their known habits; the exception being that Audubon mistook his species. The snake which pursued and caught the squirrel was evidently not a rattlesnake, but a common blacksnake, or as it is appropriately termed, the "blue racer." This to be sure is rather a gross error, and shows that Audubon was more familiar with birds than with snakes; but from a mistake to a lie is a far cry, and the fact that he mistook a blacksnake for a rattlesnake does not prove anything against the truth of his story. In fact, it is inconceivable that a scientist of such a thoroughly grounded reputation for accuracy in detail could be guilty of manufacturing such a story, even if it were possible that he could invent one so absolutely in accordance with facts without knowing the facts.

Read blacksnake for rattlesnake, and the story is absolutely accurate. The blacksnake is noted for its extraordinary swiftness and lightning-like movements; and its great powers of locomotion enable it to catch its prey, largely squirrels, in the manner alleged. It does not proceed in the leisurely, sinuous fashion adopted by other snakes, but as the naturalist states, "drawn apparently out to its full length," that is, in a practical straight line. The writer was once returning from a hunt with gun in hand, and was passing by a small barn, when there suddenly appeared at one side of it, apparently from nowhere, a blacksnake, five feet long, lying at full length; but before he could even turn around, that snake had disappeared almost as mysteriously as it appeared. It almost seemed to vanish, so rapidly did it slide around the corner of the building.

I need not consume your space by individually confirming the several elements of the narration, further than to say that I have observed every one of them personally, even to the movement of the snake's head over the body of his victim preliminary to swallowing it, which by the way is common to rattlesnakes also. The "singular movements of the whole body" after swallowing are simply peristaltic movements, which have the effect of pushing the ingested matter farther down the esophagus; and if at this point the animal be disturbed, reverse peristaltic movements are quite apt to take place, ejecting the food, which alone enables the snake to defend itself against an enemy or to make away; after the disturbance is over, the snake can then return and reswallow its prey.

But where the narrative states that "having cut a twig, I went up to it and tapped it on the head, which it raised, as well as its tail, and began for the first time to rattle," certainly (you will say) that is a lie. How could a blacksnake "rattle," having no rattles? In explanation of this, I may say that this is a habit possessed by the blacksnake and some others, viz., to vibrate the end of its tail in the same manner as a rattlesnake, and when as usual this is done in dry leaves, against a log, etc., it produces a rattling sound, which convinces the average observer that it is a rattlesnake. Darwin in his "Origin of Species" alludes to this habit of the copperhead to explain the evolution of rattles. I have never seen in print the same observation with regard to the blacksnake, but it is a very common habit, as anyone can observe by teasing one.

It is certainly strange that an observer like Audubon should not have observed with surprise that the snake killed his prey by constriction instead of by poison; but it must be supposed that this rattling incident was what deluded him, and convinced him that he was dealing with a rattlesnake.

The other facts alluded to by Audubon, such as sharpness of sight, also evidently refer to colubrine snakes and not to viperine snakes, as the latter do not, so far as I am aware, ordinarily climb trees, and are incapable of seeing overhead, on account of their projecting supraocular plates. GEORGE W. COLLES.

Milwaukee, Wis.

The Seattle Electric Railway Company has been making practical tests of various kinds of fenders for the purpose of deciding upon the type which will minimize accidents. Tests have been conducted at the company's shops at Georgetown, Washington, and those which have given promise of proving satisfactory have been attached to cars.

THE BERLIN OCEANOGRAPHIC MUSEUM.

BY DR. ALFRED GRADENWITZ.

An interesting museum connected with the Oceanographic Institute of the University of Berlin has been recently established. This museum comprises four departments, of which a short account is given in the following, the first being the Collection of the Imperial Navy.

The Historical Hall situated in the basement to the left of the entrance hall contains twenty-one pictures by Prof. Petersen, illustrating the three main epochs in the history of the German navy, from the days of the Hansa on. These are supplemented by a number of models representing typical men-of-war of different epochs, as well as some interesting relics once belonging to famous captains. A broad staircase leads to a lobby in which are exhibited models made to a scale of 1:50 of each of the vessels constituting the present German navy. A squadron of battleships at anchor is represented in a central glass case, and constitutes the principal object in this particular section of the museum. The open courtyard of the Institute, to which access is obtained from the vestibule through a covered corridor, contains some bulky parts of ships, such as spars, anchors, armored plates, figure heads, as well as the broken stem of the "König Wilhelm." In a broad corridor running along the vestibule are installed reproductions of the several compartments of the old training frigate "Niobe," while the adjoining basement contains the equipment of the hull of the torpedo boat "S. 17," with specimens of its equipment.

From the vestibule a staircase leads to the Armament Hall, in the center of which a 15-centimeter naval gun is mounted. To the right of the piece the evolution of marine artillery from 1848 until the introduction of rapid-firing guns is illustrated both by originals and models, while torpedoes and mines are represented to the left. From one of the models we learn the interesting fact that an electrically-operated air pump served to operate the first Whitehead torpedo used in the German navy. Adjoining the Armament Hall are two smaller rooms, in one of which gun-hoisting machinery as well as marine signaling apparatus are shown, while the other contains uniforms of all branches of the service. Outside are a set of charts showing the development of some of the German shipyards.

The second section comprises a number of models representing the construction of ships and ship engines. One of the most remarkable exhibits is the model to a scale of 1:10 of the fast transatlantic steamer "Deutschland"; this, as well as the models of some new torpedo engines and the engines of a few other representative ships, is operated by electricity. Models of steering and propelling engines, and up-to-date anchor-weighing machinery, different types of boilers, as well as auxiliary machinery of some of the older ships, are likewise exhibited.

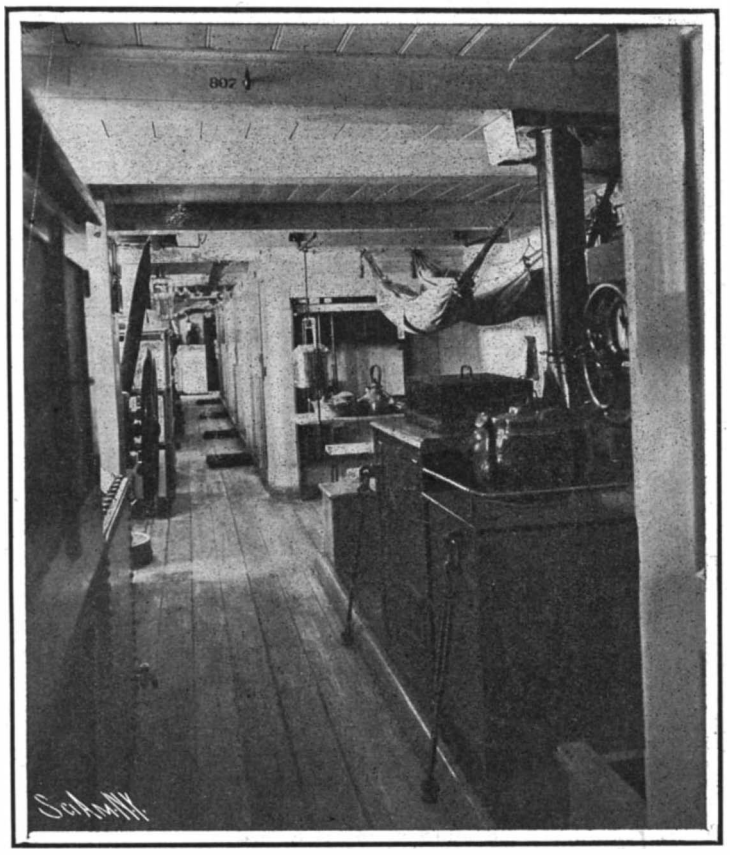
The construction of wooden and iron ships is exemplified by transverse and longitudinal cross-section models, prominent among which is that of the battleship "Braunschweig."

Models of the rigging of old frigates reproduced on a scale of 1:20 and of a modern military mast on a scale of 1:10, together with dock and launching models, should likewise be mentioned. Some models of seagoing canoes of the natives of far-away countries, especially those of the Pacific Ocean, have also been installed here, forming the first part of a special section which is to represent the ethnographic side of navigation and ship construction.

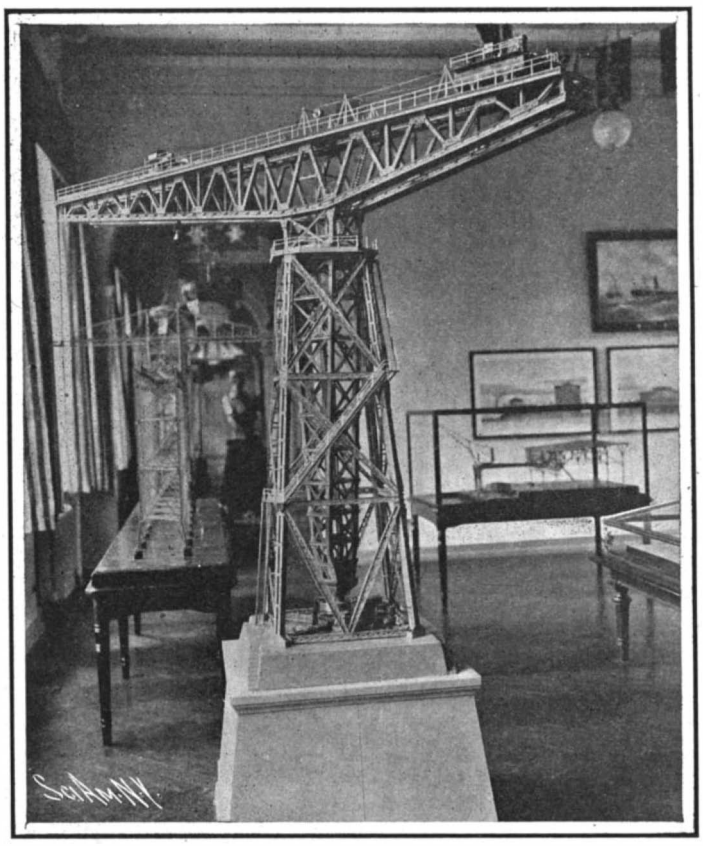
Modern navigation is also represented, especially as regards the Hamburg-American and Nord-deutsche Lloyd lines. A small reproduction of the wooden ship "Deutschland," by which the former company inaugurated their work in 1848, forms a striking contrast with models of the latest ships of both companies. The present distribution of the fleet of the Hamburg-American Line is represented on a huge map. A number of pictures represent the interior arrangement of the vessels of these two companies, as well as some of the incidents in their history. The equipment of a passenger's cabin on board an ocean steamer is exhibited in the lower corridor close to the "Niobe" exhibit.

Other groups of these collections have been installed in the central and western halls of the upper story, to which access is obtained from the staircase. Some valuable models of sailing ships derived from the collection of the German Marine Observatory have been located in front of the entrance to the central hall and inside the latter, representing each of the traditional types of sailing ship which are maintaining their own beside the giant steamers of the ocean. Among these is the five-masted sailing ship "Preussen." Tables in both corners of the hall contain devices and accessories for salvage work. Beside the various types of rocket apparatus and signaling rifles, there have been installed models of each of the lifeboats which have been or are in use on the German coast, in addition to the official equipment of these boats.

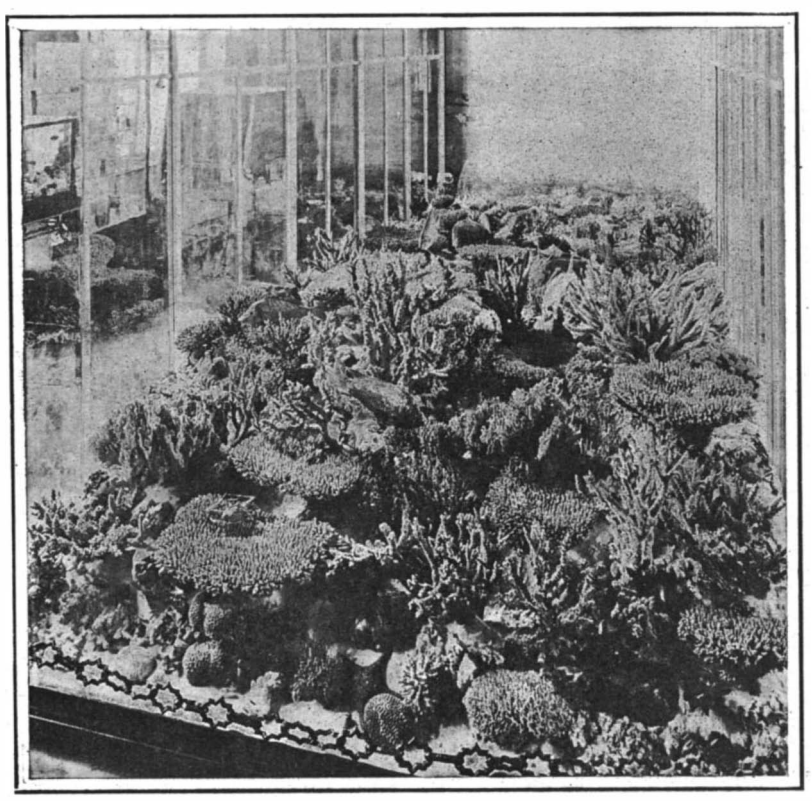
The western front hall to the left contains some exhibits relating to the equipment of harbors and shores. A large model (1:100) showing in its manifold aspects the operation of the Kaiser Wilhelm Harbor at Hamburg forms the center of this group, while various crane models, pictures of loading and unloading machinery, as well as cross sections of harbor plants are valuable complements to this model. A relief eight square meters in size of the harbor and embankments at Swinemünde is especially interesting; while of other exhibits two models of American railway ferryboats may be mentioned. The construction of lighthouses is illustrated by diagrams, and the signaling service on the high seas by a model of the Kaiserfahrt-Swinemünde course, models of both lighthouses and beacons lighted by small incandescent lamps being exhibited. The internal optical outfit of the lighthouses



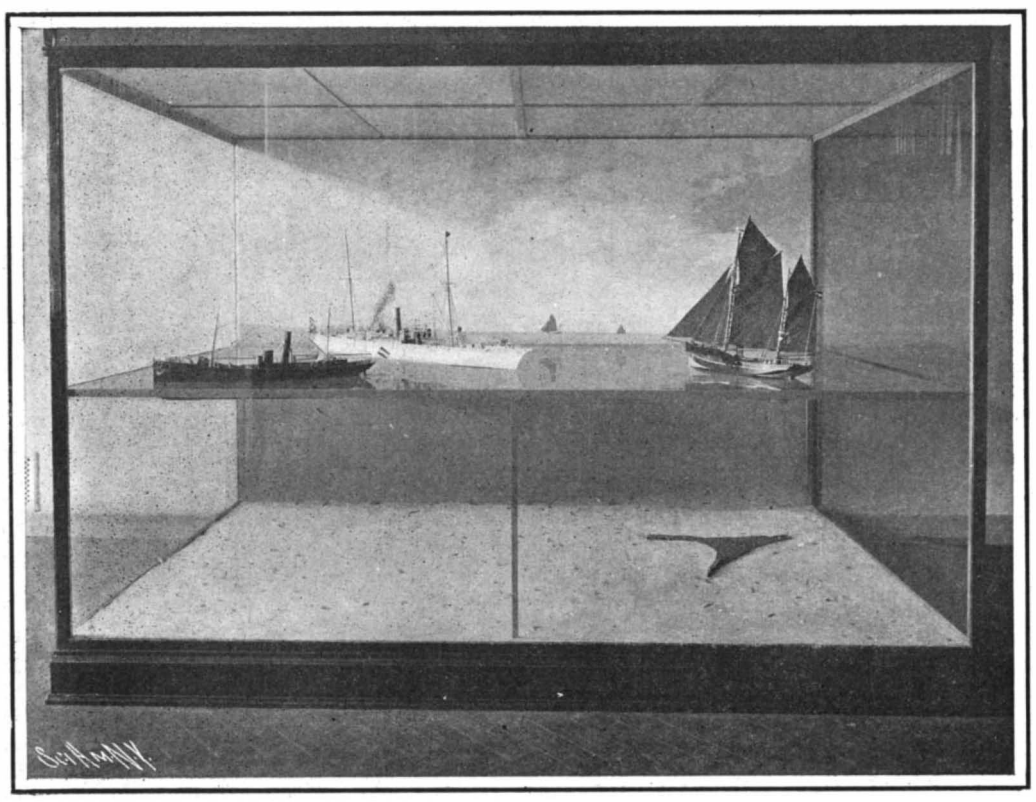
A Reproduction of a German Warship's Galley.



Model of the Great Crane at Kiel.



Coral Reef of the Sinai Coast of the Red Sea.



Steam and Sail Fishing Craft of the North Sea.

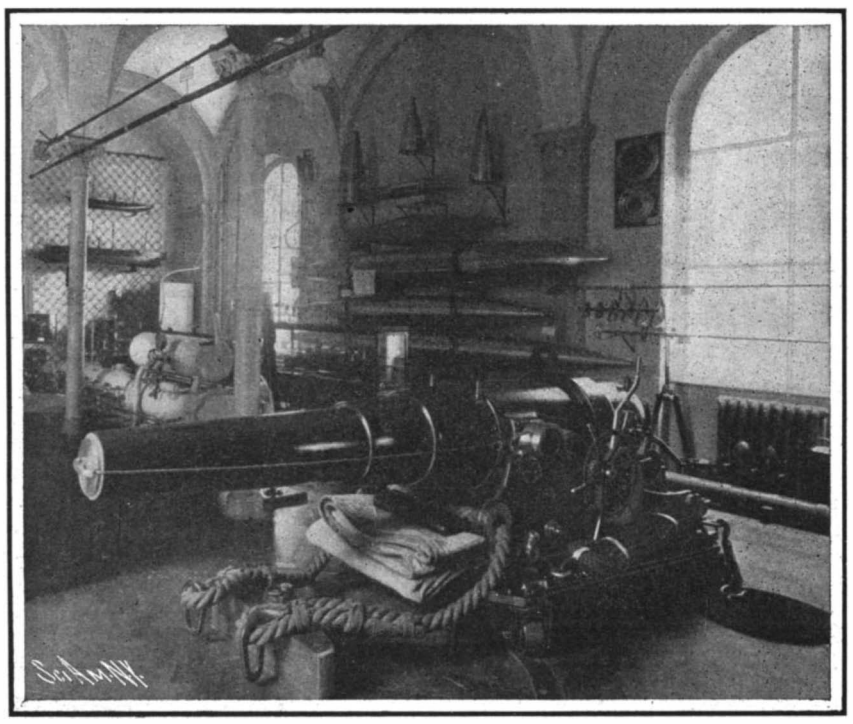
THE BERLIN OCEANOGRAPHIC MUSEUM.

is likewise on view, while the use of lighthouses for guiding and warning purposes is illustrated by an actual model. The buoying of channels is illustrated by a glass chart of the Pillau district containing models of the various signals, a storm signaling mast, semaphore, etc., illustrating the coast signaling service.

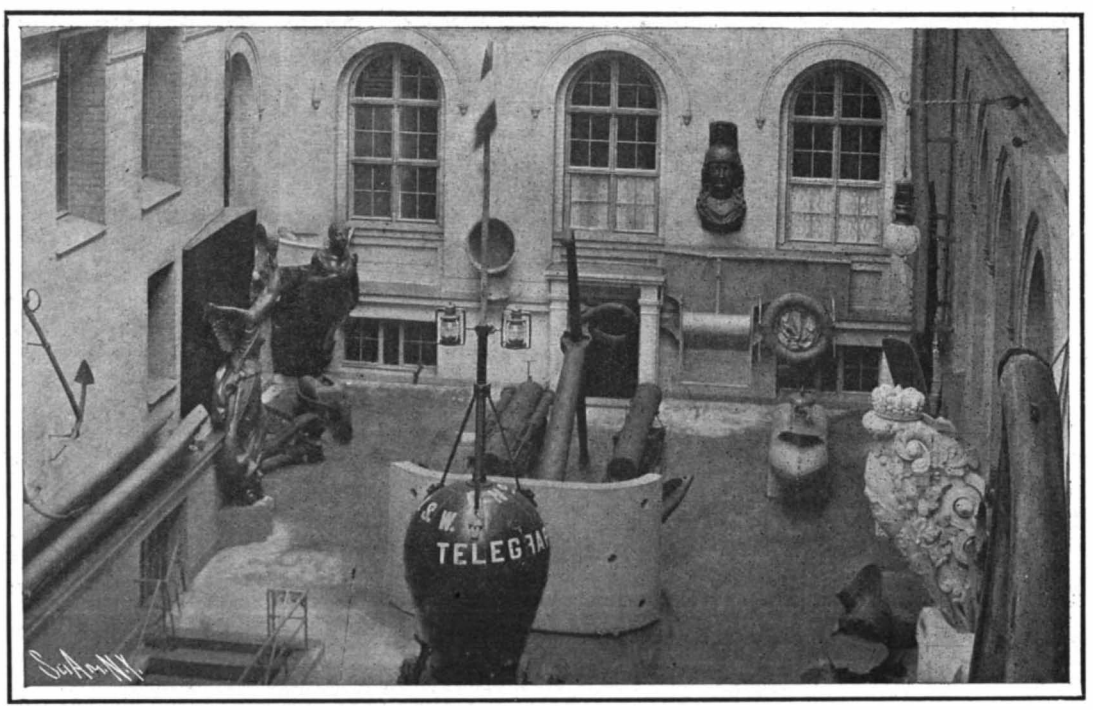
The adjoining western gallery contains collections of nautical and oceanological instruments, the first group comprising geodetical instruments with or without their stands, time-measuring apparatus and accessories, as well as the different devices used in making navigating charts. The second group comprises instruments for determining the direction of course and speed of ships. Dry and fluid compasses of different kinds with or without compensation, both steering and variation instruments, for determining the forces of terrestrial magnetism as well as for compass compensation, have been installed here side by side with the Neumayer model for illustrating the deflection of compasses on iron ships. A number of forms of compass will be found here, as well as many dead-reckoners. A few devices for determining the amount of heeling have likewise been provided. A deep-sea lead of the type used in connection with the first deep-sea expeditions of the "Challenger" and "Gazelle" is exhibited to the left of the next passage. This section will contain a representative collection of instruments for determining the depth and condition of the bottom of the sea, from the point of view of both navigation and scientific deep-sea investigation. A number of apparatus for raising samples from the bottom, even from the greatest depths, are shown, as well as the Lucas deep-sea lead for measuring depths of upward of 30,000 feet.

Another compartment of the gallery shows the different instruments used in determining the physical and chemical properties of sea water, and studying its currents; water-raising apparatus, surface and deep-sea thermometers, instruments for ascertaining the percentage of gas and salt, color and transparency of sea water, tide-current and wave-impact meters, anemometers, barometers, air thermometers, etc.

A special room to the right represents some results of much deep-sea investigation from the morphological, physical, and chemical point of view. Beside some relief maps of typical bays and harbors, marble bodies are exhibited to represent the ratio both in volume and weight between the land and sea, and the chemical composition of sea water. There is further a model of an ideal salt stratum (viz., a picture from the Berlin royal palace) illustrating the thickness of a layer which would cover the whole of the surface of the earth taken from the sea. Microscopical pictures as well as samples represent some deep-sea sediments derived from collections of the German expedition of the "Valdivia."



The Armament Hall.

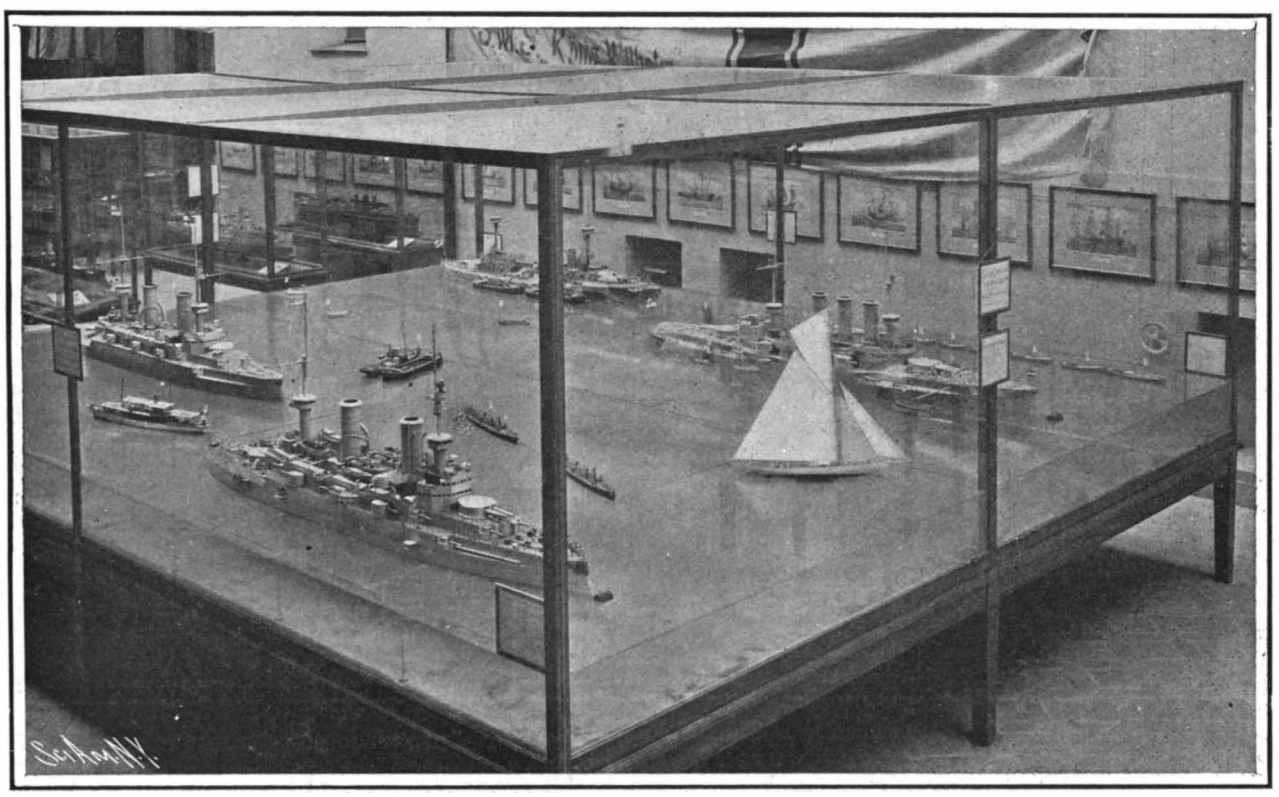


The Courtyard of the Museum.

From the oceanological department a corridor leads into a hall containing biological groups of maritime animals, the fauna of the sponge grounds of the Ægean Sea being exhibited in large alcohol reservoirs. Representatives of the mammalia and bird fauna of the Antarctic are installed to the left of the door, while the main part of the hall is taken up by a coral reef, consisting of pieces collected by a special expedition. In order to represent the reef-dwelling animals, another set of alcohol reservoirs has been installed alongside the windows of the hall, all these animals, as are the corals, being preserved in their natural forms and colors. The geological importance of reef-building corals is illustrated in two special cabinets containing skeletons of corals in their phenomena of growth and decay.

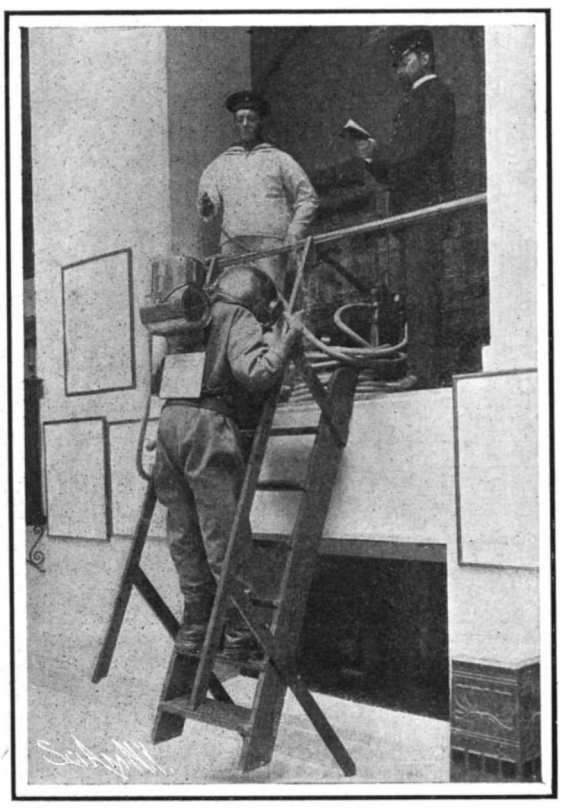
The most important useful animals of the North Sea together with some other animals and plants found in their company are exhibited in the rear side of the hall, an especially interesting exhibit being the red rock of Heligoland, of which a plastic reproduction with its fauna and algæ is on view.

The eastern gallery connected with this hall illustrates the communities of animal life on the large fishing banks of the North Sea at a depth of two hundred feet, at Heligoland cliffs at a depth of one hundred feet, and on the rocky shore of the same island at a depth of twenty to forty feet. Adjoining the partition wall of the eastern gallery is the section set apart for the economical utilization of maritime products and for the fishing industries (Fig. 6). The catching and utilization of whales and other big sea mammals is illustrated by preparations, pictures, and by an exhibition of the implements used in connection therewith (guns, harpoons, knives, etc.). The various kinds of whalebone, samples of fish oil and flour, objects made from the teeth of walrus and cachalots illustrate the manifold uses of these giants of the ocean. The Norwegian method for catching whales is shown in a picture by Carl Saltzmann, while the adjoining arch of the gallery contains a picture by the same painter entitled "Brooding Pelicans on the Peruvian Shores." Other exhibits include samples of guano and objects made from



Model of a Squadron of Battleships at Anchor.

From left to right: "Kaiser Barbarossa," "Kaiser Wilhelm der Grosse," "Woerth," "Elsass."



Group of Divers in the Vestibule.

THE BERLIN OCEANOGRAPHIC MUSEUM.

the skins of sea birds, in addition to some new and antique objects manufactured from tortoise shell, as well as a collection of the numerous kinds of sea shells used for ornamental purposes, and pieces illustrating the formation of pearls and the manifold uses of mother-of-pearl. The next group represents oyster breeding and the catching of the valuable crustacea of the sea. The gathering and utilization of amber is comprehensively illustrated, the life-size figure of an amber-catcher showing the method of gathering what is called "seastone." There are further preparations obtained from sea-plants and products derived from fishes. The various methods of catching fish are most exhaustively illustrated by exhibits, including the tools and boats in use on the different German shores.

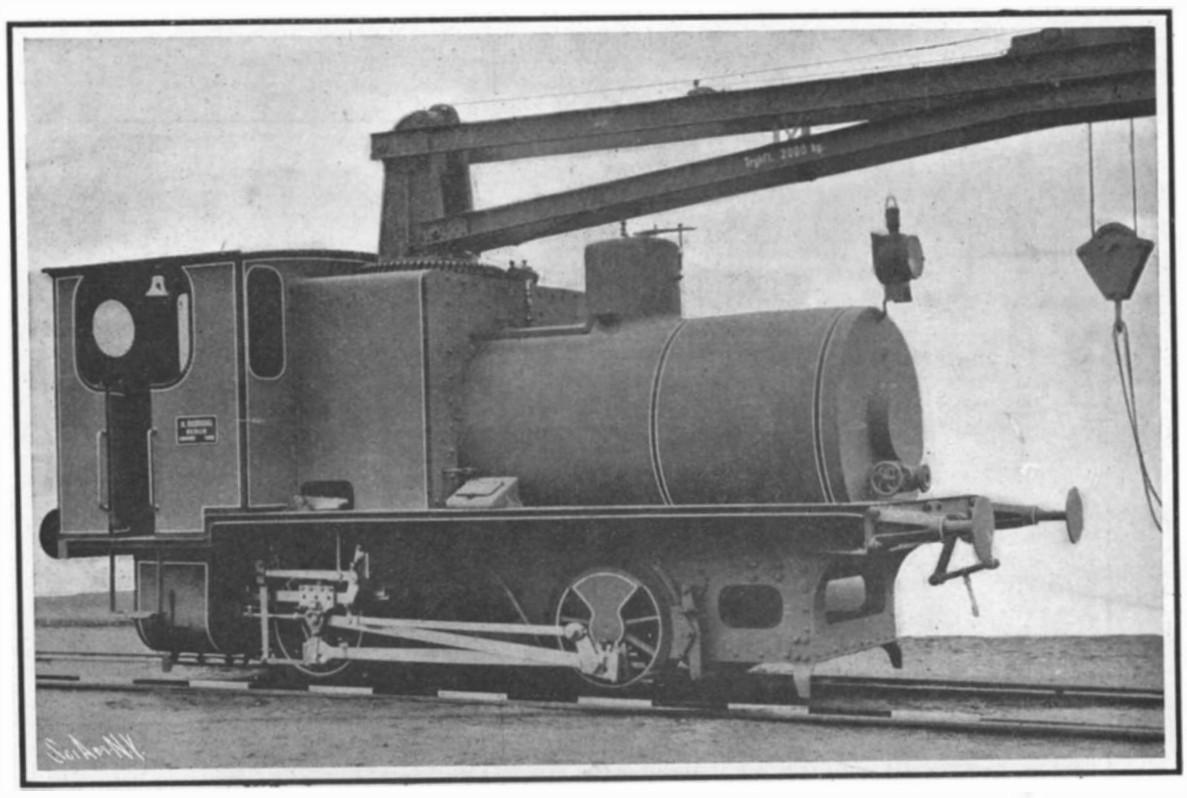
The writer is indebted to Dr. P. Dinse, superintendent of the museum, for courtesies extended to him in preparing this article, and to Messrs. Boll and Pickhardt, publishers of Ueberall, for kindly supplying the photographs herewith reproduced.

FIRELESS LOCOMOTIVES IN GERMANY.

Special Agent Capt. Godfrey L. Carden, of the United States Revenue Cutter Service, sends from Berlin an account of the fireless locomotives now used in Germany, and which, he thinks, would be of great service in the United States. He says:

The Germans are turning out a fireless locomotive, which in point of simplicity, ingenuity, and economy is thoroughly characteristic of their nation.

I have had occasion to ride on one of these fireless locomotives and its simplicity can be understood when I state that in the cab the mechanism consisted merely of a throttle bar, reversing gear, and brake. Only one man was required to run the machine, thus saving the expense of a fireman.



FIRELESS LOCOMOTIVES IN GERMANY.

As the name implies, the locomotive is fireless. There is no firebox. In general appearance the machine resembles the ordinary type of locomotive minus the firebox, funnel, and sundry other attachments. It must be understood that this type of locomotive is unsuitable for uninterrupted railway service, but is essentially a yard shunting machine; in other words, it must keep near its base of supply, and this base of supply is the boiler of some local power station. At this local power station the tank of the locomotive is filled with steam, and on this steam supply the engine will run from four to five hours doing ordinary switching work. When I entered the cab of one of these switching engines the steam gage showed a reading of 45 pounds. I was informed that two hours had elapsed since the boiler was charged and that steam was taken on at 170 pounds pressure. The chief engineer of the works stated that the boiler could limp back to its station even with steam pressure as low as one-half an atmosphere.

Contrary to one's natural impression steam is not taken on at high pressure. The pressure is about 170 pounds per square inch; in other words, it is proposed to afford the locomotive a steam pressure practically the same as that in the boiler of the power station. In order to effect this result the locomotive boiler is filled with water to about three-fourths its capacity. This water is superheated. Steam is admitted by means of a steam coupling from the power plant at the forward end of the boiler, where low down it passes through a steam admission valve. This juncture between the locomotive boiler and the boiler of the power plant is effected either by a revolving pipe connection or by means of a swaying arm, or it may be effected by a collecting pipe such as is peculiar to hydrants.

The steam on entering is mixed thoroughly with the water in the boiler tank, and the effect is to raise the tension in the locomotive boiler practically to that prevailing in the boiler of the power station, the difference being only about one-half an atmosphere, provided that the juncture is effected in the immediate neighborhood of the steam boiler and that there is little loss of tension through any great extension of pipe. Should the water in the tank be greater in quantity than three-fourths the capacity of the boiler, the quantity of heat available for work will certainly be greater—but, on the other hand, there will be the drawback of wet steam ensuing. Naturally, where there is a constant decrease in steam tension, the cylinder must be comparatively large in diameter, so that even at tensions of 3 to 4 atmospheres in the receiver the friction weight of the locomotive may be utilized to full extent. It is found in practice that even at tensions of from 1 to 2 atmospheres considerable work may be accomplished, and at tensions of one-fourth to one-half an atmosphere the locomotive is still able to go to the filling tank.

The refilling of the engine takes from eight to fifteen minutes each time, but this depends on the size of the receiver and on the fact whether the available stationary boiler can supply sufficient steam during this time.

The size of the locomotive naturally depends on the work to be performed, and in determining a type for any particular plant not only must the work be taken into consideration, but the size of the receiver must be sufficiently large to obviate too frequent fillings during the working hours. With a properly designed locomotive for normal conditions of work all necessary switching should be effected without having to refill the engine except during the noon hour. At the same time there should be sufficient margin in size allowed the boiler tank to meet any overwork that may be imposed. The engine, which I had occasion to examine while in service, seldom required to be filled, I was informed, oftener than once in four hours.

Summed up briefly, this type of engine offers absolute safety against fire which might be caused by flying sparks and all smoke nuisance is eliminated. This permits of the machine being used in sheds and other inclosures. There is marked economy, since the cost of producing steam in stationary boiler plants is less than when produced by ordinary fire locomotives. Practically there are little or no repairs needed on one of these machines; since there is no firebox the strain on the boiler is practically nil. Any incrustations which may develop need not be removed, as such deposits assist in reducing the radiation of heat.

Subjective Colors Seen in Cases of Poisoning, Etc.

Abnormal perception of subjective colors occurs in diseases of the brain, spinal cord, and optic nerve, after operations for cataract, in various infectious and other diseases, and occasionally without any apparent cause. It is produced, sometimes, though rarely, by poisonous drugs. About 100 years ago Dr. Patoniket described a case of red vision produced by henbane (*Hyoscyamus*). Since then yellow vision has often been observed as a result of the administration of santonin, the active principle of European wormseed (*Artemisia*).

Most cases of subjective color vision due to drugs escaped notice until recent years. The phenomena may now be classified as follows:

Violet vision produced by hasheesh or Indian hemp (*Cannabis indica*) and by toadstools; blue by alcohol; red by atropin, duboisin, and scopolamin (three alkaloids much used by oculists), and by excessive use of tobacco and quinine; yellow by picric and salicylic acids, digitalis, and phenacetin, the external application of chromic acid and iodoform, the inhalation of carbon monoxide, snake bites, and abuse of tobacco.

Mescal, the Mexican beverage obtained from the cactus, produces polychrome spectra, according to Dr. Ulis.

No substance which causes the sensation of green has yet been discovered.—Dr. Hilbert in Umschau.

Recent Experiments on Decapitated and Divided Fishes.

Recent physiological researches have shown that the extinction of life is not an instantaneous process, but a gradual one that affects one after the other the different organs of the body, and which may even be retarded by artificial means by giving to certain organs a temporary life, even when in appearance death has already taken place.

It was the physiologist Lagallois who first of all likened a decapitated animal to an animal simply asphyxiated. He said that if one could replace the interrupted circulation by an artificial circulation of oxygenated blood, it would not only be possible to support life in the head separated from the trunk or in other portions of the animal, but one could even call it back after its apparent extinction. It is known that this experiment proposed by Lagallois has been performed in different manners by Brown-Sequard, by Barrier, and by Hayem and others, these last ones having maintained the appearance of life in the head of a dog by injecting it with the blood from the arterial vessels of a horse.

Fish have a particularly tenacious vitality, and it is interesting to study these phenomena in them. M. A. Kouliabko, professor of the University of Tomsk in Siberia, has just communicated to the recently held Congress of Physiology at Heidelberg the result of his investigations on the subject of maintaining alive the heads of fishes. Upon the occasion of his former researches upon the resurrection of the heart, M. Kouliabko had examined the phenomena presented by the isolated hearts of fishes, particularly by the heart of the lamprey. Because, however, of the rapid cessation of activity in isolated hearts in which the artificial circulation was not maintained (which is practically impossible in such organs), the author had the idea of continuing his experiments upon the anterior portion of fish without detaching it from the heart.

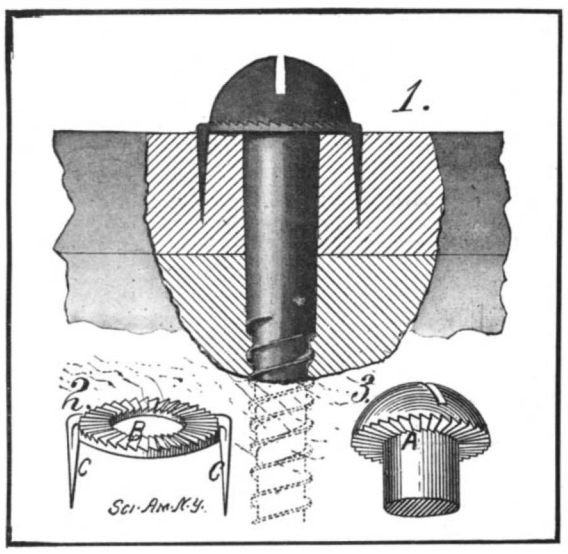
The following is a description of the method used in the experiments, according to the Revue Générale des Sciences: An artificial circulation following the normal anatomical route of the blood was established in the head and the thorax of the fish by means of a nutritive Ringer-Locks solution saturated with oxygen. To introduce the canula, M. Kouliabko made use of openings in the cardiacal or hepatical veins in the transverse section of the body. In certain cases he introduced the point immediately into the auricle of the heart. As soon as the body of the fish was cut in two, the two portions of the trunk executed lively convulsive movements, diminishing little by little, and ceasing altogether at the end of three minutes after the cutting of the animal. In the anterior portion, dyspneic respiratory movements of the bronchial cavity persisted for some time, but soon ceased also. In general, the heart continued to beat, although feebly. The below-described phenomena were produced even in the cases where the spontaneous activity of the heart had ceased altogether.

As soon as the artificial circulation was re-established in the head of the fish, all the organs of the anterior portion of the trunk started to act in a normal manner, even though the fish was placed, not in water, its natural element, but in air, and even though the blood vessels had circulating in them an artificial serum replacing the blood. This artificial activity can be maintained for hours, ceasing almost imperceptibly. The activity of the nerve centers disappears first of all, while that of the heart keeps up sometimes for days. If, after having re-established perfectly regular respiratory movements by artificial circulation, the entrance of the liquids is interrupted, dyspneic respiratory movements are again seen to appear, together with convulsions as well as irregularity of the pulsations of the heart, asphyxiation returns again, and the fish commences again to die. The rapid reaction of the nerve centers, together with the stopping of the circulation and the short duration of the interval after which the restitution may succeed, show that in spite of the relatively primitive organization of fish, their central nerve system cannot sustain a continuous supply of oxygen and elimination of the products of metabolism.—Cosmos.

Patent Department

LOCKING DEVICE FOR SCREWS.

The locking device illustrated in the accompanying engraving is adapted to be used in connection with screws to prevent the perpetration of thefts by the removal of screws from door hinges, shipping cases,

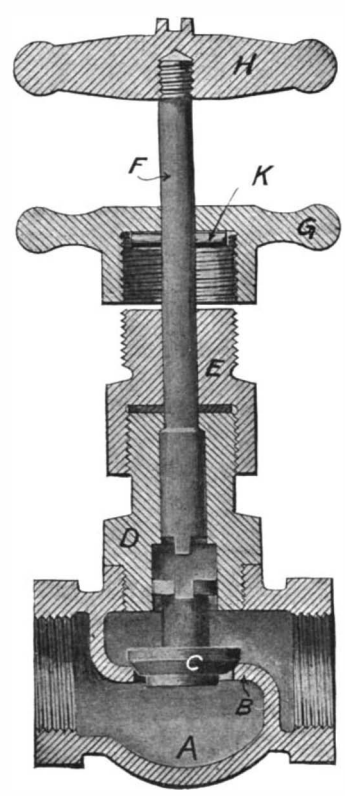


LOCKING DEVICE FOR SCREWS.

and the like. The locking device is extremely simple, consisting of a ring or washer provided with ratchet teeth which engage teeth formed on the under side of the head of the screw. The locking ring is shown in detail in Fig. 2. The serrated surface is indicated at *B* and it engages the surface *A* (Fig. 3) of the screw head. On opposite sides of this locking ring spurs *C* are formed which are adapted to be driven into the wood to prevent the ring from turning with the screw. In use the screw is first passed through the central opening in the ring and is then fitted into the hole in the wood. The bore of the ring is adapted to snugly fit the screw so that it will properly be centered. It will be observed that the spurs *C* are offset and that their butts are presented beyond the periphery of the locking ring. This construction facilitates the operation of seating the ring as the blows of the hammer may be delivered upon the spurs without striking and mashing the teeth *B*. When the screw is seated the ratchet teeth *A* engaging the teeth *B* will effectually prevent unscrewing of the screw. The inventor of this locking device is Mr. Augustin Montes de Oca, Apartado 55, Mexico, Mexico.

GRINDING ATTACHMENT FOR CHECK VALVES.

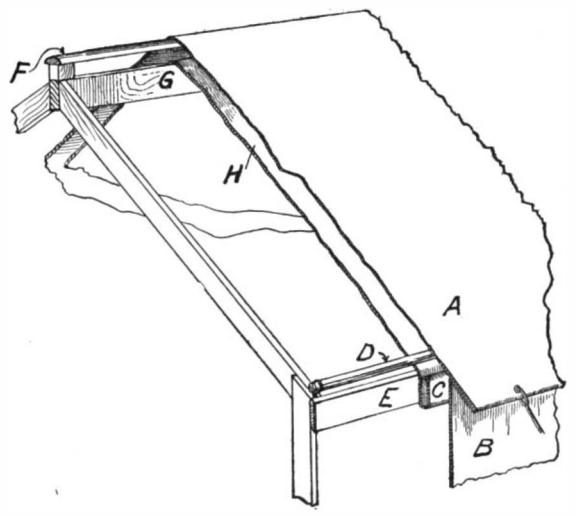
Pictured in the accompanying engraving is an attachment for check valves which will permit of regrinding the valve on its seat whenever desired without disconnecting the valve or opening the same. The device is very simple and durable in construction and can readily be applied to any check valve of standard type. In the illustration the body of the check valve is indicated at *A* and is provided with the usual valve seat *B* on which the valve *C* is seated. The stem of valve *C* is recessed to engage the end of a rod *F*, which is slidably mounted in a bonnet *D* and nut *E*. By frictional contact with the packing in nut *E* the rod *F* is normally held clear of the valve to permit the latter to function in the usual manner, but when it is desired to grind the valve on its seat the rod is forced down into engagement with the valve stem and operated to turn the valve. A handle *H* is formed on the rod to permit of manipulating it by hand, and a cross slot in the top of the handle permits of the application of a tool to turn the rod. In order to hold the valve to its seat with the requisite pressure during the grinding operation a feed nut *G* is provided which is threaded over the packing nut *E* and bears against a pin *K* on the rod *F*. After the grinding is done the nut *G* is unscrewed and the rod *F* is lifted to normal position. A patent on this grinding attachment has recently been secured by Mr. Milton P. Maxwell, of Halsey, Ore.



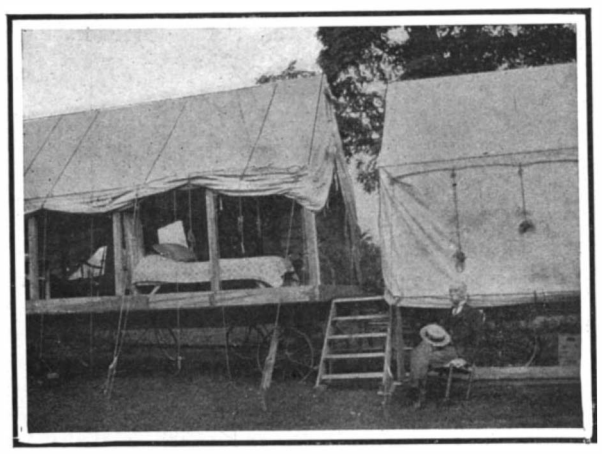
GRINDING ATTACHMENT FOR CHECK VALVES.

A CAMP ON WHEELS.

The principal charm of a houseboat lies in the fact that at any time anchor may be weighed and the boat towed to a new location. The accompanying photograph shows a counterpart of the house boat for use on land, which permits one to move from one site to another without any of the usual confusion of striking and pitching a camp. The camp is composed of tents mounted on wheels, so that they can readily be transported from place to place. As the tent floor is raised from the ground the usual unpleasant features of dampness, snakes, and insects are avoided. Special provision is made for proper ventilation in the tent itself, and the construction is such as to preclude the danger of leakage in stormy weather, so that life in these tents is rendered exceedingly healthy and comfortable. The framework of the tent is fastened together with bolts, permitting it to be taken apart and stowed away in a small space whenever desired. A double canvas roof is used. As shown in the sectional view, the outer covering *A* is doubled back on itself at the eaves, and thence drops to the floor of the tent



DETAILS OF THE TENT ROOF.

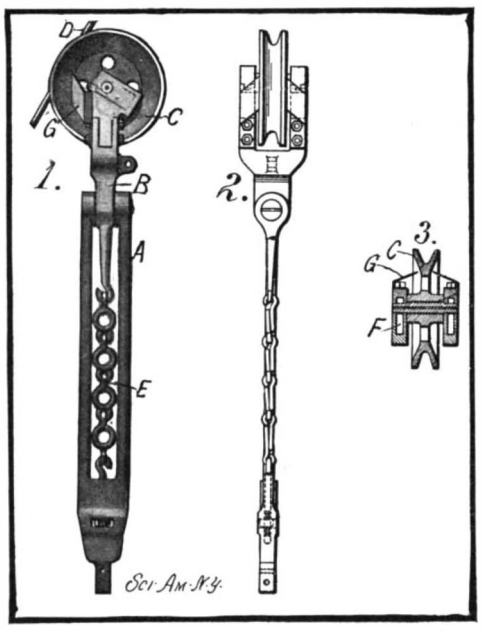


A CAMP ON WHEELS.

forming the side walls. It is supported on a rail *F*, spaced above the ridge pole *G*, and on rods *D* spaced from the eave rails *E*. The inner canvas cover is supported directly on the ridge pole *G* and eave rails *E*, and is fastened to bars *C*, which weight the canvas and keep it taut. A screened window opens into the peak of the tent and may be closed by a flap. The tents may be supported on any wheeled vehicle or even on a flatboat. When it is desired to move camp a team can be hired for the purpose from the nearest farmer. The tents shown in the photograph were used in winter as well as in summer. A stove and a lining of compo boards kept them warm even in zero weather. One of the tents furnished living and sleeping accommodations and the other was used as a dressing room, with toilet, bath, and wash rooms partitioned off at one end. Mr. Robert P. Orr, of Summit, N. J., has just secured a patent upon the tent. He suggests that the outdoor life afforded by this type of camp would be of value to persons who are suffering from throat and lung troubles.

AN ATTACHMENT FOR TROLLEY CAR POLES.

In order that the wheel which runs in contact with the overhead line wire of a trolley car system may follow this wire around curves, it is desirable that it be given a certain freedom of motion laterally. To allow for this lateral motion it is necessary to use a swiveled fork, or harp, on the end of the trolley pole, so that the wheel may move independently of the trolley pole proper. This result is accomplished in the invention illustrated herewith. A forked frame *A* is provided, in the upper end of which a harp *B* is pivoted. The harp carries the wheel *C*, whose plane of rotation is at right angles to the plane of oscillation of the harp *B*. This wheel *C* is of the usual form and contacts with the trolley wire *D*. The lower end of the harp *E* is formed with a hook to which is attached a chain *E*, formed of spring links. The opposite end of this chain is connected to a hook in the lower end

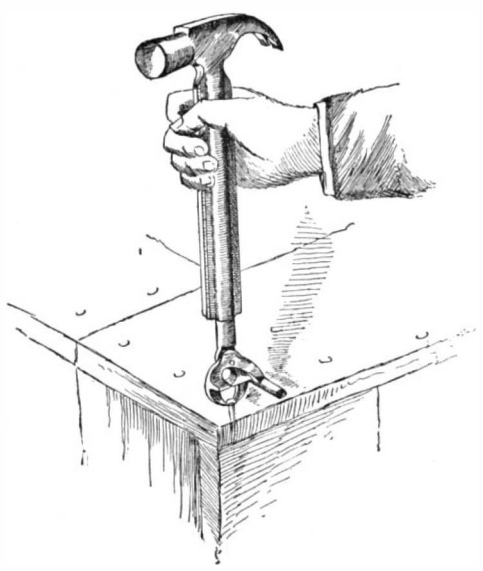


AN ATTACHMENT FOR TROLLEY CAR POLES.

of the forked frame *A*. The construction of the spring links is clearly shown in the illustration, and the chain thus formed provides a very sensitive and strong spring which will readily hold the wheel in its proper position, and yet permit the wheel to yield quickly to a sudden jar or vibration of the car. In order to provide proper lubrication the axle of the wheel *C* rotates in oil boxes, *F*, at each side. The axle is provided with a central bore through which air may freely circulate to cool the bearings. To prevent the line wire *D* from catching on the oil boxes *F*, shields *G* are provided. This attachment is adapted to be secured to the end of the trolley pole proper, and it will be observed that while motion in the plane of rotation of the wheel *C* is not permitted except as the entire pole rises or falls, lateral motion is allowed whenever the curves or sinuosities of the wire require it. The inventor of this attachment is Mr. George R. Dunn, of San Diego, Cal.

ODDITIES IN INVENTIONS.

COMBINATION TOOL.—The accompanying engraving illustrates a tool which combines in a single structure means for setting, driving, and extracting nails, tacks, brads, and the like. The tool consists of a hollow handle formed with a hammer head provided with the usual extracting claw. Fitted into the hollow handle is a stem, which carries a fixed beak and jaw. Pivotally secured to this stem is a movable beak and jaw provided with a fulcrum extension. A spring serves to keep the fixed and movable jaws normally in contact with each other. The use of the tool is shown in the illustration. Small tacks can be extracted with the usual claw. Nails may be extracted by using the beaks at the end of the hammer handle, and if they project sufficiently from the wood, they may be gripped by the jaws and extracted in the usual way by swinging the hammer on the extension as a fulcrum. In order to increase the leverage, the stem may be withdrawn as far as necessary from the hammer handle. A spring prevents the stem from dropping out of the handle. The handle of the tool may be calibrated along each edge.



COMBINATION TOOL.

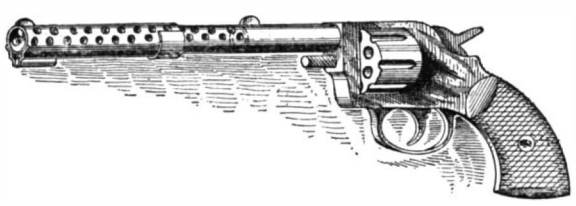
Improved Frying Pan.—It is often desirable to cook a number of dishes at the same time in quantities such that it is not economical to devote an entire pan to each dish. Illustrated herewith is a pan provided with several compartments, in which different commodities may be cooked at the same time without mixing. This should appeal to those who have to do their cooking over a gas stove, as the several dishes may be cooked over a single burner, thus economizing fuel. The partitions are made of two pieces, one bent substantially in the shape of a V, and having lateral flanges whereby it is bolted to the bottom of the pan, with the apex at the center of the utensil. The other partition is a straight piece arranged to project from the apex to the opposite side of the pan. Thus the pan is divided into three compartments. The bolt heads which are formed on the under side of the pan serve as supports to hold the bottom of the pan from direct contact with a stove.

IMPROVED FRYING PAN.

Fan Attachment for Rocking Chairs.—To most of us a rocking chair and a fan are synonymous with comfort and laziness. An enterprising inventor has rigged up a scheme whereby the occupant of a rocking chair may have his hands free for work and at the same time fan himself. The fan consists of a broad-bladed propeller, which revolves on a vertical axis at the back of the rocking chair. A vertical rod is swiveled to a roller, which is connected by a strong leaf spring to the rockers of the chair. Mounted on the back of the chair is a bracket provided with a nut or sleeve that works upon a threaded portion of the vertical rod. As the chair is rocked back and forth, the nut rises and falls, causing the rod to revolve first in one direction, then in the other. The fan is thus set in motion, but by means of a ratchet mechanism its rotation is maintained continuously in the same direction.

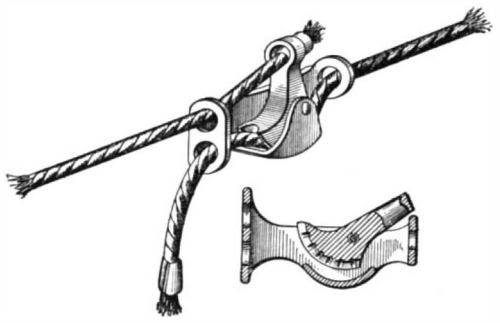
FAN ATTACHMENT FOR ROCKING CHAIRS.

Extensible Jacket for Revolvers.—A novel attachment for revolvers has recently been invented, which claims to obtain greater accuracy in firing, and also to deaden the report of the explosion by diffusing or breaking up the gases at the moment they leave the mouth of the firearm. The attachment consists of a jacket formed of several telescoping sections. This jacket is fitted over and secured to the barrel of the revolver. The sections which may be extended beyond the end of the barrel are perforated at the upper side. The result is that the revolver is provided with a long barrel, at the end of which the sight lug is fitted, thus permitting greater accuracy of aim, and when the shot is fired the gases escape largely through the perforations in the sleeve sections, thus deadening the report.



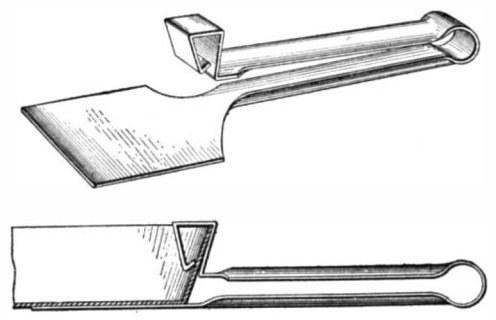
EXTENSIBLE JACKET FOR REVOLVERS.

Line Fastener.—A simple device adapted to be placed on a line to tighten or slacken it and make it longer or shorter, as required, is shown in the accompanying illustration. The device is so arranged that the tension on the rope serves to bind the fastener more tightly to the rope, and also in a very simple manner the rope may be released. The device consists of a casing in which a cam lever is mounted. The eccentric cam face of the lever is grooved and serrated. One end of the rope is passed through an opening in the front wall of the casing, and is fastened to the upper arm of the lever. The other end of the rope passes through the rear wall of the casing under the cam face of the lever, and through a second opening in the front wall of the casing. The tension of the rope serves to press lower strand between the cam face and the bottom of the socket, thus firmly gripping the line. When it is desired to release the rope, the cam lever is swung back against the tension of the line.



LINE FASTENER.

Handle for Cooking Utensils.—The device shown herewith provides a ready means for lifting a hot pan or like utensil from the stove. It is formed of a single piece of sheet metal doubled upon itself to provide a bifurcated spring handle. The lower end of the handle is formed in the shape of a blade, which may be inserted beneath the cooking utensil. The opposite end is bent to form a gripping surface, which fits over the edge of the pan. In use the two ends of the device are caused to automatically grip the pan by the very act of grasping the handle.



HANDLE FOR COOKING UTENSILS.

Coal Tar—the Most Protean Substance in the World.

Speaking recently before the Society of Chemical Industry, Mr. H. Schweitzer summarized a number of the products of the coal-tar industry. Since the discovery of mauve, half a century ago, dyestuffs after dyestuffs have been and still are evolved from coal tar, giving the whole range of the colors of the rainbow and complying with every demand of taste, fashion, and stability, surpassing in beauty, brilliancy, and fastness to time, light, and chemicals, the colors supplied to us by nature in plants and animals. A host of medicines for the treatment of the most diverse diseases has been and still is produced from coal tar; fever, sleeplessness, and pains of all origin are allayed by its various derivatives; surgical operations are rendered painless and shortened by anæsthetics made from this source. The active principles of animal glands are reproduced from coal tar, and placed at the disposal of the physician. The sleeping sickness of Africa—the disease caused by the bite of the tsetse fly—is cured by coal-tar products, and we are now on the threshold of curing cancer, the most horrible scourge of modern life, by remedies derived from this source. We make artificial sweeteners from coal tar which are 550 times sweeter than sugar; artificial oil of bitter almond and of musk are derived from this source. The odors of oil of wintergreen, violets, roses, jasmin, and heliotrope are reproduced by coal-tar products. We develop our photographic pictures with them, and use them for photography in the colors of nature. We employ them as safety explosives in mines and building operations, and the armies and navies of the world use them as smokeless powder. With coal-tar products we protect our giants of the forests against destruction by caterpillars and other insects, and preserve with them the canned goods so indispensable for the soldier, sailor, and explorer.

Cars Killed 121 in Three Months.

Statistics of accidents incident to the traffic and operation of the various surface, subway and elevated railway systems of the city, compiled by direction of the Public Service Commission, have been given out. For purposes of comparison the three successive months of December, January, and February were given.

That this monthly total of accidents is practically uniform was shown by the figures, 3,993 for December, 3,921 for January, and 3,951 for February. The deaths were 51 in December, 44 in January, and 26 in February. The accidents resulting in deaths and such serious injuries as fractured skulls and amputated or broken limbs numbered for the same months respectively 200, 188, and 139.

In each month there were hurt about three times as many passengers as persons not passengers, and, contrary to popular impressions, more persons—in fact, about twice as many—were hurt in boarding cars than in alighting from them.

Science Notes.

Trillat has shown that the natural coloring matter of red wines is precipitated by formol. If the coloring matter is thus completely precipitated and removed by filtration, the filtered liquid should be entirely colorless. Jean and Frabot give the following formula and method for the rapid and complete removal of the natural color: To 50 parts of wine add 1 part of the 40 per cent commercial solution of formol and 4 parts of pure hydrochloric acid. Heat the mixture over a water bath until precipitation is completed (a few minutes suffices), add an excess of ammonia, and continue the application of heat until this excess is driven off, as indicated by the failure of the liquid to affect red litmus paper. Then cool and filter. If the wine is pure the filtrate will be absolutely colorless, but if the wine is artificially colored the filtrate will have the characteristic tint of the coloring matter.

The food supply of the rural districts of Germany is steadily deteriorating in comparison with that of cities. The change is attributed in large part to the increasing tendency to send grain, cattle, and dairy products to the city for sale, instead of consuming them on the farm. The production of grain has increased little in several decades, during which the cities have grown rapidly. Between 1890 and 1900 the number of milch cows increased less than 7 per cent, while the consumption of milk in cities increased 78 per cent. The average annual consumption of milk per capita in a number of cities increased from 102 quarts in 1896 to 126 quarts in 1903, but in the country the average annual consumption per capita decreased from 126 quarts in 1890 to 59 quarts in 1900! As with milk so it is with other farm products. The German peasant lives no longer on grain, milk, cheese, butter, eggs, fruit, and vegetables, but subsists chiefly on potatoes, coffee, and beer. This change in the rural dietary necessarily produces evil consequences, which are but too plainly evident in the statistics of infant mortality and the records of the recruiting officers.

Imitation honey is made by several processes. The commonest consists in boiling a thick syrup of sugar mixed with a very small proportion of mineral acid. The sugar is thus converted into invert sugar, or a mixture of dextrose and levulose, similar to the sugar of natural honey. By mixing this imitation honey with natural honey of strong flavor, a product is obtained which deceives the best judges of honey. The fraud can be detected, however, by means of Ley's reagent, which is prepared in the following manner: 10 parts of silver nitrate, dissolved in 100 parts of water, are mixed with 20 parts of a 15 per cent solution of sodium carbonate. The precipitate which falls is removed by filtration, washed, and dissolved in 115 parts of a 10 per cent solution of ammonium chloride. The solution is kept in well-stoppered bottles in the dark. A few drops of this solution are added to a little of the suspected honey, diluted with twice its weight of water, and the mixture is heated for five minutes on a water bath in the dark. In these conditions natural honey turns dark brown and exhibits greenish yellow fluorescence, while imitation honey assumes a lighter brown tint and shows no fluorescence. It is asserted that the presence of as small a proportion of imitation honey as 25 per cent can be detected in this way.

The Polish chemist Jentys has been making a study of potato-starch which has led to results widely at variance with the generally accepted view of the nature of starch. According to Jentys, starch grains are composed, not of a homogeneous chemical compound, but of a colloidal mixture of an oxidizable sugar with substances of the aromatic series nearly related to tannin. The characteristic coloration of starch by iodine is due to the presence of these aromatic compounds, of which one is colored blue, another red, and a third yellow by iodine. The stratified structure of starch grains is produced by the separation, during the solidification of the liquid mixture, of the particles of carbohydrate from those of the colloids akin to tannin, and their deposition in alternate layers. The stratification is a physical, not a physiological phenomenon. The red starch of sorghum and some other plants differs from ordinary starch only by containing a larger proportion of tannic substances. Finally, the transformation of starch into sugar is not a process of hydrolysis, as is commonly assumed, but consists simply in the separation of the already existing sugar from the aromatic compounds. Acids effect the transformation by decomposing these substances, while enzymes probably cause separation without decomposition.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT.—BERTHA GALLAND, New York, N. Y. The invention relates to night-gowns, wrappers, kimonos and the like, and the object is to provide an expensive yoke, and a durable body of ordinary white goods, to permit of washing the body as often as required independent of the yoke and without subjecting the expensive yoke to ruinous washing action, the yoke being only cleaned from time to time, thus insuring long life and permitting its use with a number of bodies.

GARMENT-SUPPORTER. — BLANCHE NEWTON, Pardeeville, Wis. This supporter is adapted for use in supporting gloves, stockings, or other similar articles of wearing apparel, and the object of the improvement is to provide a device readily applied and adjusted to the desired position and adapted to support the garment at a plurality of points around the arm or leg to prevent sagging or wrinkling. It will be substantially concealed when in use.

PRESS FOR NECKTIES.—S. MILLER, New York, N. Y. In this patent the invention relates to the care of wardrobes. More specifically, the improvement relates to a small hand press which is adapted to be used for holding neckties or cravats when not in use. The pressure exerted upon these articles of neckwear removes wrinkles and creases, and restores their original appearance. If a wrinkled tie is placed in the holder and in the device the wrinkles will be removed by the pressure if left over night, or for a sufficient length of time.

Electrical Devices.

CUT-OUT.—J. H. BOOTH, F. E. BLAUSEY and A. M. SMITH, San Pedro, Cal. The invention has reference to protective apparatus for telephones and other low-tension circuit instruments, against burning out by the action of lightning or through crosses with lighting or other high-tension circuits. Signal or signals furnish an indication at any desired point of the condition of affairs.

RECEIVER FOR TELEPHONES.—L. STEINBERGER, New York, N. Y. The invention provides, 1. the receiver with a self-locking cap which cannot ordinarily be moved without taking the former apart; 2. provides the receiver with resonating chambers for improving acoustic qualities of the sounds; 3. distributes the magnets to better advantage relatively to the center of vibratory diaphragm of the receiver; 4. provides the receiver with a compound magnet for drawing the diaphragm; 5. provides a receiver casing such as will reduce the danger of breaking the receiver cap; 6. holds the casing in position by the locking member which serves also as guide for the conductors; and 7. embeds a portion of the magnets and wires with a core of insulating material.

Of Interest to Farmers.

FRUIT-PICKER'S PLATFORM.—C. A. MCDERMOTT, Sultana, Cal. The platform is made in the form of an annular segment extending about half way around the tree, suitably mounted on legs of sufficient height to bring the picker up into easy reach of the fruit on the branches and of a diameter adapted to the tree, preferably about twelve feet, so that when once in place the picker is enabled to gather the fruit from one-half of the tree without changing position of the platform.

CORN-HARVESTER.—R. B. BREWER, Oxford, Kan. This farm wagon attachment is particularly adapted for harvesting Kafir corn, but may be used for ordinary corn. It is an improvement upon the invention for which Mr. Brewer formerly filed application for Letters Patent, and he has devised changes and attained advantages, especially by reduction of the weight and cost of attachment, and lessening side draft and leverage of the wagon body, while the efficiency of the apparatus has been increased.

CORN-SHOCK LOADER. — G. WINEMILLER and G. GENTSLINGER, Wapakoneta, Ohio. The truck with attached apparatus, is drawn between the shock to be loaded and the wagon on which it is to be placed; then, the post being rotated so as to bring a pulley over the shock, a chain loop is applied thereto, and, the draft animal attached to the draft-rope being driven forward, the shock is hoisted to due height and the post rotated to swing the arm over the wagon, whereupon the animal is stopped and the windlass braked by the hand mechanism, or the block is pressed down upon the rope, so that the shock will descend upon the wagon without undue rapidity.

COTTON CLEANER AND DISTRIBUTER. —R. L. HOLLINGSWORTH, Decatur, Ga. An exhaust fan withdraws air from the air chamber through the outlet, producing a partial vacuum, which causes an inward current through the outlet pipe. Air entering through this pipe is laden with raw cotton, carried upon the current in a helical swirl, this direction given by a guide plate. The cotton then passes through guide sleeves and through a chute on to wings of a shaft, into a cylindrical chamber, and by means of the wings, fed out of the chute. Means provide full pressure in the pipe; also prevent tendency of air to pass through the guide sleeves at one point.

INSECT-DESTROYER.—G. W. DARNELL, near Edna, Tex. An object of the inventor is to provide a simple, strong, and efficient destroyer, by means of which the insects and more particularly boll weevils and the like can be removed from vegetation and destroyed, and which does not interfere with the ordinary cultivation of the vegetation and does not injure the same in any way.

CORN GATHERING AND HUSKING MACHINE.—N. M. ANDERSON, Galva, Ill. The invention is an improvement in machines for use in gathering and husking corn in the field and discharging the same into a wagon or other convenient means for receiving it, all of the operations being performed automatically as the machine is drawn over the field.

Of General Interest.

BUILDING MATERIAL.—J. STANLEY, New York, N. Y. The object of the invention is to provide material for use as a building or partition block, slab, ceiling plate, lath and the like, and arranged to combine strength with lightness and to aid in rendering the walls and ceilings of buildings in which the material is used sound proof, weather proof and fire proof.

GUIDE-LUBRICATOR.—J. H. RUSH, Boston, Mass. The lubricator is especially designed for elevators. The object of the invention is to provide a receptacle for holding a lubricant as grease or graphite, which will admit of the guide passing thereinto in contact with the lubricant, and in which the latter will tend to move toward the guide as it becomes exhausted.

FIRE-DOOR FASTENER.—R. B. LAWRENCE, New York, N. Y. The invention pertains to means for securing a fire door in locked position, so as to prevent a fire from spreading in the interior of a building. When doors of this character are subjected to excessive heat arising from a fire, the doors warp and shrink transversely of their length, thereby forming an aperture between the edge of the door and its casing or its adjacent door section, and enabling the flames to spread by passing through the aperture. This invention prevents the fire from spreading beyond said door.

APPLIANCE FOR ADDING TO THE RECORD SPEED OF VESELS.—W. LAUDAHN, Los Angeles, Cal. In the main, the invention consists of a system of pipe or other conduits which are placed upon the exterior of the submerged portion of the hull, said pipes leading from a tank within the hold. The tank contains an oil, emulsion or like liquid having no or but little affinity for water. The oil, etc., by means of the apparatus, is ejected in minute quantities and distributed to the submerged portion of the hull, reducing friction as the boat plies through the water, in addition to preventing the hull from fouling to a considerable extent.

MOLD FOR MAKING CEMENTITIOUS ARTICLES.—D. A. KEOGAN, White Haven, Pa. The object here is to provide a mold for making articles of cementitious material such as burial vaults and the like, and arranged to allow the operator to conveniently open and close the mold and to properly support the molded article while setting and hardening. The invention relates to molds such as shown and described in Mr. Keogan's former application for Letters Patent of the United States.

RULE.—W. J. DE LASHMUTT, Astoria, Ore. More particularly the invention relates to flexible rules such as tape measures. One object is to provide a rule, by means of which a right angle with respect to any line can be easily determined. Further, to provide a flexible rule comprising jointed sections which are proportioned to permit the arrangement of the sections into a triangle of predetermined angularity.

FRAUD-DETECTING BOTTLE. — F. H. WATERMAN, Norwell, Mass. The invention has reference to bottles which are provided with means for indicating whether the contents is genuine. The object is to produce a bottle which is simple in construction, but which will operate effectively to prevent the fraudulent refilling and reselling of the bottle with a spurious mixture.

SURVEYING INSTRUMENT.—F. A. WAUGH, Amherst, Mass. The object of the improvement is the provision of a simple, strong, and inexpensive surveying instrument having a drawing-board constituting a plane table and an adjustable alidade adapted to be pivotally mounted upon the board at a plurality of points.

FILTER.—C. A. YOUNGMAN, Louisville, Ky. More particularly the invention pertains to that class of filters for clarifying turbid liquids such as distilled spirits, fermented liquors, and impure water. One object is to provide a filter having means for supporting the sheets of filtering material whereby the filter sheets are carried by the supporting members at knife edges of the latter.

GREENHOUSE CONSTRUCTION. — J. H. RICE, Ashtabula, Ohio. A purpose of the invention is to provide a construction of greenhouse wherein a heavy supporting girder for the roof is in the form of a gutter, acting as a secondary gutter to carry off drippage or condensations on the inner face of the roof and to so arrange the girder that it is not exposed to the changes of the weather, being at all times surrounded by the heated air within the structure.

LADDER.—W. JONES, Bowling Green, Ky. This improvement consists of an adjustable leg or foot attachment for ladders whereby the latter may be adjusted to rest, and maintain themselves vertically, upon sloping or uneven surfaces without danger of tipping or falling. It is applicable to ordinary ladders, extension ladders, step-ladders, trestles, and like structures or devices.

EVAPORATOR.—G. H. GRIMM, Rutland, Vt. This evaporator is for use in the manufacture of maple sugar, sorghum, fruit jellies, and other food products, and arranged to insure a steady flow of the sap, to prevent any scum and sediment from mixing with the sweet syrup or like product, and to insure the production of a pure, light-colored syrup of high color and fine flavor.

EXCESS-BAGGAGE COUPON-CHECK. — F. H. CRUMP, Los Angeles, Cal. This baggage strap-check is provided with duplicate checks underneath an ordinary excess-baggage strap-check and with carbon paper inserted to enable an agent to fill out, at one writing, the same data on the strap-check, the agent's stub, and the passenger's duplicate, as well as to punch simultaneously through all the parts, certain constant or known data, at considerable saving of time and labor over various kinds of checks.

BARBER'S POLE.—J. R. WYGLE and A. R. WYGLE, Leavenworth, Kan. Important features comprise a plurality of independent rotatable sections, and an operating device for each one, consisting of an annular series of blades, each blade flaring outwardly toward its open end, the blades of each series being arranged with the reduced end of one in the enlarged end of the succeeding blade, the blades on one section oppositely to those on the other. The pole rotates by action of the wind and exhibits a plurality of series of spiral stripes usually red, white, and blue. Those upon one casing run opposite to the stripes on the other. It may be supported vertically, horizontally, or reversed with the top downward.

Hardware.

TURPENTINE-HACK.—C. E. RAYFORD, St. Elmo, Ala. The hack is symmetrically made and has two hook-shaped cutting edges and two holding lugs and in the combination of the same with the handle whereby the longevity of the implement is increased, a better and stronger connection is made with the handle and the work of chopping the trees is done in the most approved manner.

WRENCH.—D. C. PIERCE, Nowrytown, Pa. In the operation of the improvement a spring forces the jaw into locking engagement with the locking teeth, and by pressure upon the thumb piece the locking pawl may be released from engagement with the wrench bar so it may be adjusted along the same to any desired position. By removing the cover plate access may be conveniently had to the dog and its spring for any desired purpose.

LATCH.—I. W. HERMAN, Cotesfield, Neb. The latch secures a door in closed position, and also guards against accidental displacement of the locking-bar, whereby the door is permitted to freely swing open. The latch is of special value to farmers and others for barndoors, feed-doors, etc., where it is necessary that the door be so secured that a shrewd animal will be unable to dislodge the locking member.

SHUTTER-FASTENER.—H. F. CHREITZBERG, Winston Salem, N. C. An object in this case is to provide a fastener by means of which the shutter, door or the like can be surely locked in position, and which cannot be released from the outside without breaking the shutter or other closure, or the frame of the same. Another is to provide a device which automatically engages the catch of the shutter or other closure to lock the same in position, and which is held in normal operative position gravitationally. Mr. Chreitzberg has also invented another shutter fastener by means of which the shutter, blind, door or the like can be securely locked in position and which cannot be opened from the outside without breaking the shutter or other closure, or the frame of the same. The device locks the shutter or the like and is held in an operative position gravitationally.

CLIP.—H. G. ADDIE, Cresco, Iowa. The invention consists of an improved clip for holding pens, pencils, stamps, and other like articles as are ordinarily used about a desk, and is preferably applied thereto to a partition between the pigeon-holes or other convenient place where it will be accessible yet in an unobstructing position.

SCISSORS OR SHEARS.—S. F. F. LINDAL, New York, N. Y. The object in this case is to have a construction especially adapting the scissors for cutting a number of thicknesses of cloth or similar material. But more specifically to increase the power or cutting force of the shears, and to provide an arrangement for enabling the blades of the shears to be held in good working contact without necessitating constant regrinding.

Heating and Lighting.

FEED-WATER REGULATOR.—C. A. DUNHAM, Marshalltown, Iowa. The object of the invention is to provide means for automatically regulating and controlling the pump which returns the water of condensation from the radiators to the boiler, whereby the pump will be automatically started in operation upon the accumulation of a predetermined quantity of water in the receiver and the operation of the pump interrupted when the water falls below said predetermined limit.

SMOKE-CONSUMER FOR BOILER-FURNACES.—J. D. NIX, Natchez, Miss. The object of the inventor is to provide a consumer, and its combination with the masonry "setting" for a steam boiler which will intimately mix waste carbon with oxygen from the surrounding air and subject it to sufficient heat for its proper association, and under air pressure force the aero-carbonaceous mixture in the form of jets into portions of the fire-chamber of the steam generator for its combustion and conversion into heat for steam generation.

SAFETY ATTACHMENT FOR BURNERS.—W. A. CALDWELL, JR., Roswell, New Mex. The object of the inventor is to provide a safety attachment for burners, which prevents the escapé of gas or other fuel to the burner unless the fuel is ignited. Further, to provide means controlled by the heat of the burner for operating a fuel inlet valve, and further, having means for igniting the fuel burner from a point remote from the burner.

BURNER.—J. O. MORGAN, Oakland, Cal. The invention pertains to hydrocarbon burners, and its object is to provide a burner for burning fuel oil, and especially designed for use in boiler furnaces and other places; and arranged to insure complete combustion of the fuel without forming undesirable residue, and to permit using a low grade oil.

INSTANTANEOUS WATER-HEATER. — A. E. SHIPLEY, Nelson, British Columbia, Canada. The invention pertains to water heaters employing gaseous fuel, and comprises an improved device in which the water is heated by direct contact with the products of combustion, being exposed thereto in films on the surface of non-absorbent balls or the like and in the form of fine spray falling from perforations in plates, as well as in thin films of water flowing over the surface of heated plates or drums.

Machines and Mechanical Devices.

MACHINE FOR GRINDING AND POLISHING.—L. A. JONES, Clyde, Ohio. This inventor has patented a seemingly very ingenious machine for use in grinding and polishing, more particularly in cutlery. The machine embodies various distinctive features relating to the supporting and carrying of the work to be ground toward and from the polisher or grinder. The arrangements of the parts being such that the grinding or polishing operations are controlled by the movement of the convenient system of controlled levers.

LEVER FOR LIFTING-JACKS. — G. R. BOOTH, Chana, Ill. The jack embodies a slotted standard, a block for supporting a load and carried by said standard, and an actuating lever engaging the standard for elevating or depressing it. The more particular design of the invention is to afford novel details of construction for an operating lever, that is especially well adapted for co-operation with the lifting jack formerly patented by Mr. Booth.

YARD-METER.—W. B. SCHULTZ, Phillipsburg, N. J. One of the relations of this invention is to adjusting mechanism whereby the general position occupied by the meter may be varied automatically in reference to the supporting framework, in such manner as to cause the meter to operate upon only the selvage or some other predetermined portion of the cloth to be measured, the general position occupied by the meter varying from time to time with variations in width or position of the cloth.

ICE-CREAM FREEZER.—MARY A. ROWE, West Hoboken, N. J. In this freezer a plurality of different substances may be frozen at the same time in the same device and the materials thoroughly and efficiently agitated without the use of special stirring mechanism. The containers are provided with a central tube whereby the freezing medium may be applied both externally and internally, and at the same time an annular chamber is formed within which the materials are caused to rapidly circulate in opposite directions upon the oscillation of the containers.

MECHANICAL MOVEMENT.—G. A. HUMPERT, Pittsfield, Ill. The inventor provides a movement, more especially designed for converting reciprocating motion into rotary motion or *vice versa*, in such manner that dead center positions are avoided, and the motion during the forward or backward stroke or both, is even throughout. The ideal application of the link mechanism is preferably in conjunction with internal combustion engines where the driving arm would be directly pivoted to a single element and to have the driving stroke correspond with the perfect semi-circuit of the crank.

CLOCK-MOVEMENT.—G. SYLVAN, J. B. SYLVAN and E. W. SYLVAN, Columbia, S. C. In a former application for a patent filed by these inventors, the object was to provide means for securing a more uniform transmission of power from the main spring to the escapement. The present improvement has the same object in view and employs some of the same instrumentalities, but comprises the novel means of controlling the automatic winding action through the recurrent action of the striking mechanism of the clock.

STONE-SAWING MACHINE.—J. M. OWENS, Oolitic, Ind. The improvement pertains to stone working and its purpose is to provide

a stone sawing machine which is simple and durable in construction, very effective in operation, and provided with wire saws cutting a stone quickly and accurately into a series of slabs of the desired thickness.

TARGET.—J. Arbat, New York, N. Y. An object in this invention is to provide a target for use in shooting galleries, rifle ranges and the like, which has a target disk or object provided with a movable bull's-eye controlling a movable figure, which when the bull's-eye is struck by a bullet, advances toward the shooter and tenders a prize or executes some other evolution or movement indicative of the shooter's success.

EXCAVATOR.—C. Suiter, Billings, Mont. The excavator is arranged for travel on rails or on the ground to and from the place of excavation, and is capable of quick and accurate positioning, to permit of bringing the buckets into the most effective working position, for cutting into a bank of earth, clay, shale, rock or other material, or picking up loose material, such, for instance, as is blasted down in mines or tunnels.

MACHINE FOR PINNING LEATHER ON SOLES OF WOOD. — W. Schou, Peder Skramsgade 3, Copenhagen, Denmark, and H. Busse, Augsburgerstrasse 96, Berlin, Germany. The tacking is effected by means of a reciprocating hammer, the sole with the attached upper being supported on the sliding carriage which moves past the hammer. At the moment the tack is driven in, the sole remains stationary and is then moved only a certain distance farther while the hammer is carried back. During movement of the sole, means provide for directing the hammer against the groove in the rim of the sole, into which tacks are to be driven.

SAWMILL SET-WORKS. — N. E. Rice, Zenia, Cal. One leading object here is to adapt the invention to use on mills, working logs of varying lengths, particularly long logs, and to avoid possibility of the log being shifted or set out on the carriage before it is clear of the saw. This is attained by mounting the adjustable track on a bed which is itself adjustable without, however, interfering with the gearing for independently adjusting the track, so that by adjusting the bed the position of the track with respect to the sawmill carriage may be regulated, and the set works caused to operate only when the log is clear of the saw.

CIGAR-VENDING MACHINE.—M. R. Meredith, Wabash, Ind. The invention is in the nature of a new automatic machine designed to be operated by a motor and gears set into operation by the deposit of a coin. It is intended primarily for vending of cigars, but may be employed for vending packages or units of any other kind of merchandise which are of uniform size.

COMBINED PROTRACTOR AND LEVEL.—H. E. Gregory, Fruitvale, Cal. One purpose of the inventor is to provide details of construction affording means for the speedy and exact duplication of the profile or contour of any object within its range of capacity, upon a flat surface of paper, wood, or other suitable material, and thus enable the speedy and exact duplication in lineal delineation of the object thus copied.

Prime Movers and Their Accessories.

TUBULAR STEAM-BOILER.—C. Röhrs, Landsberg-on-the-Warthe, Germany. Certain special steam chambers have the drawback that access to the middle shell is rendered difficult and that in order to clean the tubes by which the steam enters said shell, the partitions forming such chamber have to be removed. This is overcome by Mr. Röhrs by causing steam to pass from the foremost direct into the hindmost shell and thence into the middle one. A steam chamber is unnecessary, cost is reduced and safety of boiler increased.

ROTARY ENGINE.—P. O. Pōulson, Brigham, Utah. The aim of the invention is to produce an engine, which will operate efficiently and economically. And further to provide a construction whereby the steam which is projected upon the rotary member will be thrown back into steam pockets in the casing, so that the steam in these pockets can flow later onto the rotary member so as to accelerate its velocity.

Railways and Their Accessories.

STATION INDICATOR.—R. Toennes, Boonville, Mo. The indicator is of the double reel and web type. The object is to provide means for actuating the reels and to take up the web as the car progresses, said means comprising primarily pneumatic devices operated by the turn of the car axle. The device includes a let-off or unwinding reel, and a take-up or winding reel; and when the end of the trip is reached the web may be rewound on the former reel, for the next trip.

RAIL-BRACE.—B. A. Fleshman and J. M. Koontz, Fayetteville, W. Va. The aim of the invention is to provide a brace arranged to prevent spreading of the rails at curves, switches and other places, to relieve the outer rail on curves of undue strain and to subject the inner rail to a strain equal to that on the outer rail, thereby dispensing with curve braces, double spiking of the outer rail and like expedients.

TRAIN-SIGNAL.—F. P. Page, Syracuse, N. Y. The intention in this case is to provide a train signal more especially designed for use on the caboose or rear car of a freight train, to enable a tower-man along the track to see where the rear end of the train is coming and to indicate to the engineer whether the train is intact or not.

CRANK-PIN-TURNING MACHINE.—M. H. Westbrook, Port Huron, Mich. The object of this inventor is to provide a new and improved machine for turning crank-pins on locomotive drive wheels and arranged to permit convenient and accurate attachment of the machine to the wrist pin, with a view to insure perfect truing thereof according to the original quartering.

STREET-RAILWAY SWITCH.—P. McGrath, Denver, Col. The invention is an improvement in street railway switches. In the construction shown in the present patent, the switch is operated by a plurality of vertically swinging levers provided with cam-shaped surfaces projecting through slots in the casing which incloses the mechanism. By one form of modification the improvement is especially adapted for underground trolley roads. Mr. McGrath has invented another street-railway switch, wherein, when the motorman desires to throw the switch he will depress a vertically slidable shaft corresponding to the swinging lever belonging to the switch which he wishes to operate, and as the car passes over the said lever it will be depressed.

CAR-FENDER.—C. R. Reeves, Fairhaven, Mass. One purpose here is to provide a readily attached car fender, in the construction of which the bottom section is adjustable relatively to the body, so that its outer end may be brought within the vertical plane of the outer end of the platform, or be carried outward as far as desired and locked in either position.

MAIL-HANDLING APPARATUS.—W. C. Thornton, Jefferson City, Mo. An object of the inventor is to provide an apparatus for delivering mail bags and similar objects from moving trains in such manner that injury and excessive wear of the bags is obviated, and by means of which the delivery can be effected from trains moving at high rates of speed.

SANDING APPARATUS FOR LOCOMOTIVES.—A. O. Martin and C. A. Hahnel, Denison, Tex. The purpose in this instance is to provide an apparatus which will adapt the improved sanding device for reliable service, prevent clogging of the same with wet sand, and furnish a coacting shut-off valve that enables the discharge of same from the elevated sand-holding box to be arrested when this is desired.

Pertaining to Recreation.

BOWLING-BALL AND HANDLE.—F. J. McGuane, Chicago, Ill. The objects in this improvement are to provide a handle grip by which a bowling ball may be held conveniently by the player, the handle grip fitting the player's hand and being so constructed that it may be readily and instantly freed from the ball at the will of the player with sufficient momentum to carry it down the alley.

TOY.—F. Beaumont, Jr., Argentine, Kan. The toy is of the class intended to be trundled or rolled along the ground. An object of the invention is to provide an inexpensive toy, which when operated performs certain mechanical movements and thereby causes ornamental or other figures to be actuated in a realistic manner.

Pertaining to Vehicles.

SHOCK-ABSORBER FOR VEHICLES.—W. C. Williamson, New York, N. Y. The invention has reference to shock absorbers such as used on the bodies of vehicles, and especially automobiles. The intention is to produce a device of this class which is simple in construction and which can be very accurately adjusted so as to give any resistance or absorption of shock desired.

OIL-SPREADER.—W. M. Murray, Sawtelle, Cal. This spreader is particularly useful for the purpose of incorporating oil, tar, asphaltum and the like with the earth, or other material of roads. One of the several objects of the invention is to provide a spreader, by means of which the oil or other fluid is atomized and forced into the roadway at an appreciable distance below the surface of the same.

BOLSTER STAKE.—J. Heimlicher, Defiance, Ohio. The purpose of the invention is to provide details of construction for a wagon bolster stake, that is adapted for convenient longitudinal adjustment, so as to afford lateral support to the sides of wagon bodies that may have different heights.

Designs.

DESIGN FOR A COLOR-CARD.—T. R. Manley, Montclair, N. J. The design in this case includes a card of three sections that fold into a box-like form. Each division is ornamented with leaves and berries of a plant, and each leaf and berry contains a different sample of silk and of a different color or shades of a color.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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References to former articles or answers should give date of paper and page or number of question.

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(10732) P. N. asks how to retard the setting of plaster of Paris. A. When, for some reason, in making plaster casts or bandages, it becomes desirable to retard the setting of the plaster magma, this may be accomplished by adding to the water powdered althæa root in the proportion of two to four per cent. When dry, such casts may be sawed, filed, and turned. An addition of eight per cent of althæa retards setting for a full hour, and the mass may be kneaded, rolled, and otherwise shaped. The addition of a very little alum or ferric chloride produces a very hard cast. Good plaster should not set in less than three minutes.

(10733) B. M. P. asks for a formula for an acid free soldering fluid. A. For the production of antacid soldering fluid, sheet zinc waste is placed in hydrochloric acid. As regards quantity, enough should be used, that after complete saturation there is still an excess of zinc. After a few days the excess of zinc should be removed and the solution diluted with equal volume of water and filtered. Now add liquid ammonia, drop by drop, until the precipitate forming in the beginning has just dissolved again. If the solution of ammonio-zinc chloride is mixed with starch paste, a sirupy liquid is obtained which is employed as soldering paste in cases where the shape of the article to be soldered does not well admit the use of liquid soldering water. The water is well adapted for soldering tin plate, iron, and brass. The solder for galvanized iron wire consists of lead, 3 parts, and zinc, 1 part.

(10734) B. S. asks how to make paraffine paper. A. Dissolve paraffine in benzine, and into the warm solution dip the paper, sheet by sheet; let drip off and dry. On the large scale it may be done by letting paper from a continuous roll pass through such a solution and then between flannel to absorb the surplus. Wax is best dissolved in carbon disulphide, and paper can thus be made ready for use in five minutes. Quite a good plan is to apply the benzine solution of paraffine by means of a sponge.

(10735) G. A. B. asks how to make frozen or solid perfumes. A. In the first place, the solid perfume is merely perfumed hard paraffine. The hard paraffine is melted and perfumed at as low a temperature as possible, and for a mold use the lids of 2 drachms chip boxes. White Rose Solid Perfume.—Oil of geranium, ½ drachm; oil of bergamot, ½ drachm; oil of patchouli, 5 minims. From 1 to 5 drops to each block may be used, according to the moderation or extravagance of the manufacturer. Lavender Solid Perfume.—Oil of lavender, 2 ounces; essence of bergamot, 1 ounce; oil of cassia, 5 minims; oil of geranium, 40 minims; oil of orange, 5 minims. Mix and perfume the wax as before. Bouquet Solid Perfume.—Oil of coriander, 18 minims; oil of cloves, 2 drachms; oil of nutmeg, 1 drachm; oil of lavender, 3 drachms; oil of sandal, 1 drachm; oil of bergamot, 1 ounce; otto of rose, ½ drachm; oil of geranium, ½ drachm; oil of orange, 10 minims. Mix. Cologne Solid Perfume.—Essence of bergamot, 1 ounce; essence of lemon, 1 ounce; oil of citronella, ½ ounce; oil of neroli, ½ ounce; oil of rosemary, 80 minims; oil of geranium, 10 minims. Mix.

(10736) P. N. J. asks how to make koumiss. A. 1. Fill a quart champagne bottle up to the neck with pure milk; add two tablespoonfuls of white sugar, after dissolving the same in a little water over a hot fire; add also a quarter of a two cent cake of compressed yeast. Then tie the cork on the bottle securely, and shake the mixture well; place it in a room of the temperature of 50 deg. to 95 deg. Fahrenheit for six hours, and finally in the ice box overnight. Drink in such quantities as the stomach may require. Be sure that the milk is pure; that the bottle is sound; that the yeast is fresh; to open the mixture in the morning with great care, on account of the effervescent properties; not to drink it at all if there is any curdle or thickening part resembling cheese, as this indicates that the fermentation has been prolonged beyond the proper time. 2. To a quart of new milk add a sixth part of water, and to this mixture add, as a ferment, an eighth part of the sourest buttermilk that can be got. In future preparations, a similar quantity of old koumiss will better answer the purpose of a ferment. Cover the vessel with a cloth, and allow to stand in a place of moderate warmth for twenty-four hours, when a thick substance will be found collected at the top. Stir well until this substance is thoroughly mixed with the liquid portion beneath, and allow to stand for twenty-four hours more, when, having filled a bottle two-thirds full, and again thoroughly mixed by shaking, the preparation, now called koumiss, may be used at once, or the bottle tightly corked and kept in a cool place for future use. Always shake the bottle well before using.

(10737) T. F. M., Jr., asks for a formula for floor polish. A. Potash, 1 part; water, 4 parts; yellow beeswax, 5 parts; hot water, a sufficient quantity. Emulsify the wax by boiling it in the water in which the potash has been dissolved; stir the whole time. The exact amount of boiling is determined by the absence of any free water in the mass. Then remove the vessel from the fire, and gently pour in a little boiling water, and stir the mixture carefully. If a fat-like mass appears without traces of watery particles, one may know the mass is in a fit condition to be liquefied by the addition of more hot water without the water separating. Then put in the water to the extent of 200 to 225 parts, and re-heat the compound for five to ten minutes, without allowing it to reach the boiling point. Stir constantly until the mixture is cool, so as to prevent the separation of the wax, when a cream-like mass results, which gives a quick and brilliant polish on a woodwork, if applied in the usual way, on a piece of flannel rag, and polished by rubbing with another piece of flannel.

(10738) N. W. A. asks how to make Pharaoh's serpents. A. These are little cones of sulphocyanide of mercury which, when lighted, give forth a long, serpent-like, yellowish brown body. Prepare nitrate of mercury by dissolving mercury dioxide in strong nitric acid as long as it is taken up. Prepare also sulphocyanide of ammonium by mixing 1 volume sulphide of carbon, 4 strong solution of ammonia, and 4 alcohol. This mixture is to be frequently shaken. In the course of about 2 hours, the bisulphide will have been dissolved, forming a deep red solution. Boil this until the red color disappears and the solution becomes of a light yellow color. This is to be evaporated at about 80 deg. F., until it crystallizes. Add little by little the sulphocyanide to the mercury solution. The sulphocyanide of mercury will precipitate; the supernatant liquid may be poured off, and the mass made into cones of about ½ inch in height. The powder of the sulphocyanide is very irritating to the air passages, and the vapor from the burning cones should be avoided as much as possible. To ignite them set them on a plate or the like, and light them at the apex of the cone.

(10739) C. L. T. asks for a modeling compound. A. Mix 200 parts dry clay or powdered soap stone with 100 parts of wheat flour; stir the mixture carefully into 300 parts of melted white wax, not too hot. If desired, the mass may be colored at pleasure. The so-called "modeling clay" may be made by kneading dry clay with glycerine instead of water. The mass must be worked thoroughly with the hands and moistened at intervals of two or three days. To prevent evaporation, it should be kept covered with a piece of rubber cloth.

(10740) N. J. S. writes: If a person stands evenly on both feet and endeavors to move one forward and the other in the opposite direction, the tendency is to turn the body while the feet remain stationary. If the right foot is pushed forward the body turns to the right, and if the left foot is pushed forward the body turns to the left. But at the same time we have the power of holding the body in a fixed position at all times, so that one foot can be slid forward and the other one slid backward and *vice versa* without changing the position of the body. It seems to be easy to understand what muscles are brought into play to perform the first act, but I can't figure out what additional muscles are employed to hold the body in position in the second place. I have been trying to apply these two movements to a mechanical device, but so far have met with failure. Will someone be kind enough to give me some information on this subject? A. We are able to move our feet as you describe by a sudden jerk applied to both feet and an opposite motion applied to the upper part of the body. Probably both parts do not move at the same instant. Probably also we raise the weight of the body by a slight jump from the floor as we twist our feet around. We found we did so when we were testing your experiment. We seem to apply two forces in opposite directions at once, one to the feet and the other to the head and shoulders, so that the feet move one way and the shoulders move as far in the opposite direction. We thus leave the head and shoulders in the same position as they were at the start.

(10741) L. Z. says: What is the maximum speed of a gasoline motor per minute? A. We have no "record" figures of the maximum speed attained by gasoline engines, but speeds of several thousand revolutions per minute, 2,000 to 3,000, are quite readily obtainable with engines of the automobile type.

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Short descriptions and splendid photographs of the locomotives in use all over the world.

STORAGE BATTERIES—THEIR THEORY, CONSTRUCTION, AND USE. By A. F. Watson. Lynn, Mass.: Bubier Publishing Company. 16mo.; cloth; 142 pages, illustrated. Price, $1.50.

Beginning with the theory of the storage battery the reader is led through chapters dealing with their action and construction to how to set up storage batteries, switchboard arrangements, and the various types in common use. In closing a description is given of typical storage-battery installations.

EDUCATIONAL WOODWORKING FOR HOME AND SCHOOL. By Joseph C. Park. New York: The Macmillan Company, 1908. 12mo.; cloth; 310 pages, 362 illustrations. Price, $1.

A work giving descriptions of methods and of tools rather than of the positions to be assumed while using them. This portion of the field of an elementary guide is omitted, since the book is designed for class use under a competent instructor. In two parts, it is not intended that one part shall be completed before the other; the division being rather one of kind than of degree. A "Schedule of Work" gives a plan of the work to be followed; this may be varied to suit local conditions. The matter on "Tools," "Technical Operations," and the like may be given in the form of regular recitations, presenting an opportunity of calling attention to some of the theories underlying the subject.

POWER AND POWER TRANSMISSION. By E. W. Kerr. Second edition. New York: John Wiley & Sons. 8vo.; cloth; 366 pages, illustrated. Price, $2.

The book has been improved by rewriting the chapters on Steam Turbines and Valve Diagrams, also by the addition of several pages of matter upon the subject of heat and the use of the steam table, at the beginning of the chapter upon steam boilers. The steam table of the old edition has been replaced by another one, more complete and better adapted to the solution of problems. A large number of good problems have been added and a thorough correction of errors made throughout the book. The present edition contains 175 problems and ten pages more matter than the former edition.

THE ELEMENTS OF RAILROAD ENGINEERING. By William G. Raymond. New York: John Wiley & Sons. 8vo.; cloth; 405 pages, illustrated. Price, $3.50.

A railroad with its rolling stock and buildings constitutes a manufacturing plant which its owners operate in the manufacture and sale of transportation. The "layout" or arrangement of a modern manufacturing plant is as much an item of design as is each individual machine or process. This book attempts to describe the fixed portion of a railroad plant and to give the underlying principles of the design of its layout. A policy adopted in the preparation of the book has been to treat briefly and generally those subjects which are fully and well covered in special volumes, to which the student is referred, and to go into detail in those subjects treated only in books of the same class as this one. An effort has been made to indicate at least indirectly that there are other methods of doing things than those presented, and to lead the student or reader to think of other possible ways than those described in the book. The sequence of arrangement and the method of treatment will commend themselves to the student and teacher. In the introduction there are presented briefly, and perhaps far from completely, rational ideas of railroad political economy. The paragraph on the comparative worth of cross-ties is thought to be sound and to furnish correct principles for economic investigations in other directions. The brief discussion of the locomotive as a traction engine will be found valuable, and the articles on curve resistance and the cost of the worst class of rise and fall, which are original, will be found correct. The article on reconnaissance estimates, and that on the work of the residency, will perhaps be of service to young engineers on their first work.

LES RÉCENTS PROGRES DU SYSTEME MÉTRIQUE. Rapport Présenté à la Quatrième Conférence Générale des Poids et Mesures, Réunie à Paris en Octobre, 1907. Par Ch. Ed. Guillaume, Directeur-Adjoint du Bureau International des Poids et Mesures. Paris: Gauthier-Villars, 1907. Quarto; 94 pages and four figures. Price, $1.50.

Few authorities have a better grasp on modern metrological problems, both practical and theoretical, than M. Guillaume of the International Bureau of Weights and Measures, and this report submitted in October, 1907, to the general committee of the Bureau is a clear statement of the present state of metrology as well as of the recent growth and use of the International Metric System. It describes the minute examination and comparison of various Bureau and national standards, which demonstrate that the stability and exactness of the prototypes are being maintained. In addition, recent experiments of Perot and Fabry further insure the accuracy of the determination of the length of the meter in terms of the wave length of light as first executed by Michelson. Other fundamental physical measurements, as of the volume of a cubic decimeter of water, and of temperature, carried on at the Bureau and tending toward the better defining of the metric units, are outlined and the results concisely summarized. The report also treats recent legislation throughout the world dealing with the metric units and standards, among which are the laws of Denmark, May 4, 1907, by which the metric system was adopted for that country. A full account is given of the practical application and extension of the use of the metric system in various countries, and especially its use in new industries. In buying and selling precious stones and jewelry it has been found possible to adopt and use a metric carat of 200 milligrammes to take the place of a large number of measures, varying more or less according to the place where employed. M. Guillaume's work should be read by every student of weights and measures, and especially by those interested in the attempts to introduce the metric system into the Anglo-Saxon countries, Russia, and Japan.

JAHRBUCH DER SCHIFFBAUTECHNISCHEN GESELLSCHAFT. Neunter Band. Berlin: Verlag von Julius Springer, 1908. Quarto; cloth; 506 pages, illustrated.

The year-book of the Society of Marine Engineers contains some interesting papers and a large number of excellent photographs of subjects dealing with boats and the like. The group of pictures showing motor boats at high speed is very worthy of note.

WIRELESS TELEPHONY. In Theory and Practice. By Ernst Ruhmer. Translated from the German by James Erskine Murray. With an appendix by the translator. New York: D. Van Nostrand Company. 8vo.; cloth; 224 pages. Price, $3.50.

Wireless telegraphy has arrived at a thoroughly practical, if not entirely satisfactory, stage of development, while wireless telephony is scarcely more than in the experimental stage. This may be laid to the door of the fact that it is extremely hard to produce vibrations of the same frequency as those needed for the reproduction of the human voice, although by various arrangements of the singing arc or of some similar source of light and the selenium cell, speech has been clearly transmitted over considerable distances along a beam of light, it is only recently that electrical energy has been made to perform this work with sufficient ease to point to the ultimate solution of the problem in a commercial sense. The kind of detector used seems to be largely a matter of convenience or choice, so that the sending apparatus is the important thing to perfect. Mr. Erskine-Murray, in his translation of Ernst Ruhmer's original German work, follows the course laid out for him by that well-known experimenter. The work deals mostly with the various methods of transmitting speech without wires, both by light and by electricity, laying the greatest emphasis upon the most important phase of the subject, Methods of Transmission.

ARCHITECTURAL COMPOSITION. An attempt to Order and Phrase Ideas Which Hitherto Have Been Only Felt by the Instinctive Taste of Designers. By John Beverley Robinson. New York: D. Van Nostrand Company. 8vo.; cloth; illustrated; 234 pages. Price, $2.50.

The author of this excellent and instructive volume once published a series of articles in the Architectural Record; articles that afterward appeared in book form. This series formed the basis of a course of lectures given before the School of Architecture at Columbia University, and from the lectures the contents are taken. The theories contained in the work can hardly be questioned, being, as they are, recognized individual truths, so broadened and expanded as to fit the general case. The method followed is to reason, from groups of somewhat widely distributed examples, to universal principles, driving home the ideas by half-tones under which appear suggestions as to the chief points to be noted in each building portrayed.

METHODS AND DEVICES FOR BACTERIAL TREATMENT OF SEWAGE. By William Mayo Venable. New York: John Wiley & Sons. 8vo.; cloth; 236 pages, illustrated. Price, $3.

The engineer who has in charge the building of sewage purification plants has to deal with problems that have many and diverse factors entering into them. Besides the bacteriological side of the science, which is largely taken care of by the trained biologist, he must be familiar with the principles of flow in open channels, the hydraulics of filter-beds, and a number of similar subjects. The factors, too, change entirely with the change from aerobic to anaerobic systems; indeed the variation with changing conditions is of almost infinite possibility. With the exception of the introduction and Chapter II, in which the literature of Bacterial Sewage Purification from the standpoint of the civil engineer is summarized, this book is devoted to the engineering side of the problem.

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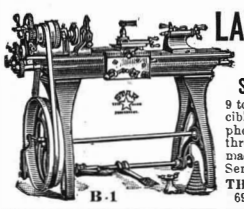

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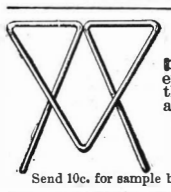

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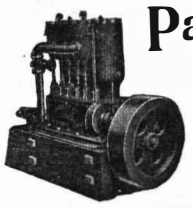

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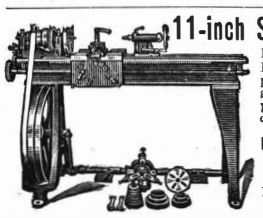

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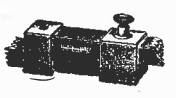

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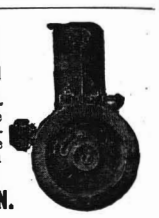

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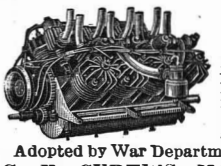

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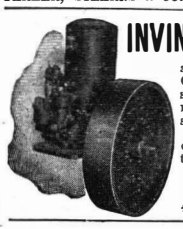

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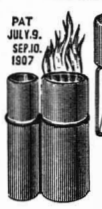

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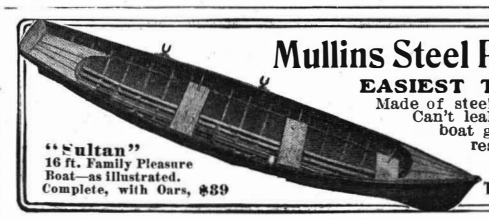

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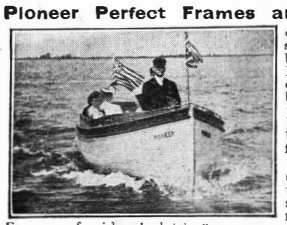

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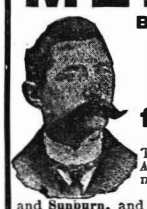

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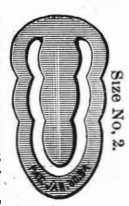

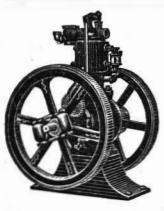

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Propeller, G. W. Hopkins	885,250
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Propeller wheel, H. J. Perkins	885,174
Puller. See Beet puller.	
Pulley, ratchet cylinder, A. Leatherman	885,060
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Pump, air, G. W. Kellogg	885,485
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Rail fastener for concrete ties, E. J. Drayer	885,456
Rail joint, R. F. Wolynec	885,122
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Railway rail joint, E. C. Ale	885,561
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Railway signal and telephone system, F. L. Odenbach	885,367
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Spoon, mixing, A. W. Cram	885,444
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Spring wheel, H. E. Heaton	885,342
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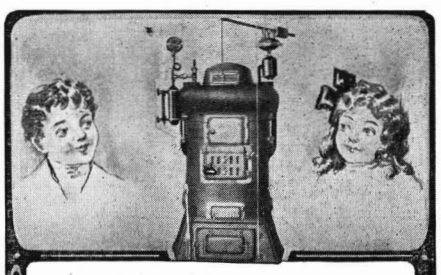

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Write for particulars and our booklet, "What Owners Say About Their Nationals."

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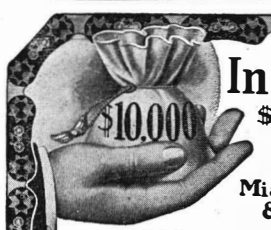

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has less pressure on its crank hanger bearings than any ordinary bicycle built; therefore, that it pushes easier and runs faster with less energy and will climb hills easier. The explanation is found in the special Crank Hanger construction and large Sprockets of the **Racycle.** 1908 Models are built with drop forged steel heads, crown and seat post clusters and the frames are made of English cold drawn weldless steel tubing made especially for us. We build **Racycles** as near non-breakable as money, materials and workmanship will permit.

Write for 1908 catalog and pamphlet—"The Three Reasons", which contains our offer. We make no cheap RACYCLES but you can secure yours cheap if you secure us an agent.

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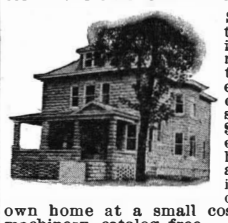

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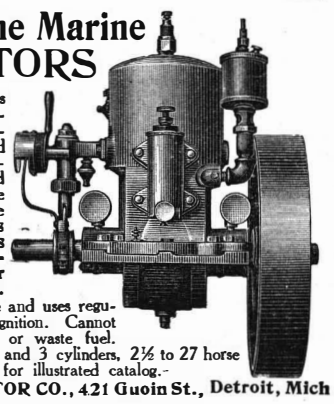

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OUR BUSINESS IS TO MAKE MACHINERY FOR GRINDING GRAIN, CRUSHING ROCKS AND PULVERIZING ALL HARD SUBSTANCES. WE HANDLE ALL KINDS OF MATERIALS FROM COTTON-SEED TO ROOTS AND HERBS, BY AN UNEXCELLED PROCESS. IF YOU WANT ANY KIND OF A MILL OR GRINDING MACHINE, COME TO US AND YOU WILL GET THE BEST AND STILL SAVE MONEY.

DEAL WITH US ONCE AND YOU WONT CHANGE.

ESTIMATES FREELY FURNISHED.

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Add TONE to your Stationery in the OFFICE, BANK, SCHOOL or HOME by using only Wasbburne's Pat.

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THE O.K. MFG. CO. Dept. X **Syracuse, N.Y.**

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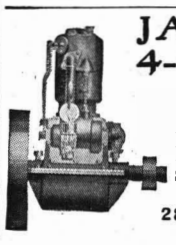

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5 HORSE POWER

Bore 6 x 6 inches.

Plenty of cooling surface. No engine ever constructed with so few working parts.

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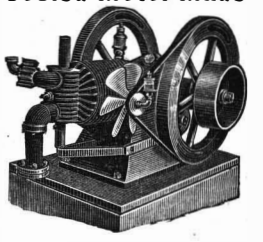
Gasoline tank in base or outside.



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WANTED.—The services of a man who thoroughly understands the manufacture of sulpburic acid; particularly one who is well versed in the latest and most up-to-date machinery and processes, as Superintendent to take charge of this department of the business of a manufacturing corporation. Address Superintendent, Box 773, New York.

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MALLET, Paris, Spherical Balloons and Dirigibles. Chauviere. Paris, Aeroplanes, Helicopteres. Antoinette Aviation Motors. Hue Aeronautical Scientific Instruments. Agent, A. C. Triaca, 2 East 29th St., N. Y.

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GLASS TUBING AND RODS. Experimental apparatus made to order from glass tube. Homeopathic vials and chemical appliances. Eastern Glass Co., Bradford, Pa.

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BUTCHER'S BOSTON POLISH is the best finish made for floors and interior woodwork. Not brittle; will not scratch or deface like shellac or varnish. Send for free booklet. For sale by dealers in Paints, Hardware and House Furnishings. The Butcher Polish Co., 356 Atlantic Avenue, Boston, Mass.

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Inquiry No. 8611.—Wanted to buy springs for light power purposes.

Inquiry No. 8612.—Wanted to secure locomotives propelled by vapor engines.

Inquiry No. 8613.—Wanted to buy smoke consumers for house heaters.

Inquiry No. 8614.—Wanted to buy pearl button machinery.

Inquiry No. 8615.—Wanted to buy a machine for breaking the hull of the almond nut without breaking the fruit.

Inquiry No. 8616.—Wanted to buy for export to Porto Rico perforated metal shelving.

Inquiry No. 8617.—Wanted to buy for export to Porto Rico complete baking plant for 1,000 loaves daily.

Inquiry No. 8618.—Wanted to buy for export to Porto Rico elevator or lift worked by hand or motor, capacity one ton.

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Inquiry No. 8623.—Wanted to buy electric cooking stoves with battery attached.

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Inquiry No. 8637.—Wanted to buy lawn mower grinders.

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Inquiry No. 8642.—Wanted to buy a gasoline motor inspection car standard gage.

Inquiry No. 8643.—Wanted to buy concrete post machines.

Inquiry No. 8644.—Wanted address of glass tube manufacturer who does bending.

Inquiry No. 8645.—Wanted to buy parts for curling irons.

Inquiry No. 8646.—Wanted to buy cheap small motor from ¾ to 1 horse power, single phase 60 cycle, 110 volts

Inquiry No. 8647.—Wanted to buy steel hat pins 8 inches pointed at both ends.

Inquiry No. 8648.—Wanted to buy small steam saw mill using lumber waste for fuel. Western manufacturer preferred to save freight.

Inquiry No. 8649.—Wanted to buy non-inflammable celluloid.

Inquiry No. 8650.—Wanted to buy file cutting machinery.

Inquiry No. 8651.—Wanted to buy apparatus for making gas from oil.

Inquiry No. 8652.—Wanted address of manufacturers of drop forged wrenches.

Inquiry No. 8653.—Wanted addresses of dealers in sheet steel, New York City preferred.

Inquiry No. 8654.—Wanted addresses of case-hardeners in New York.

Inquiry No. 8655.—Wanted to buy leather for motor cycle mud guards.

Inquiry No. 8656.—Wanted to buy parts of models and gear wheels.

Inquiry No. 8657.—Wanted to buy a small water motor.

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Inquiry No. 8661.—Wanted to buy machinery for making cutlery.

Inquiry No. 8662.—Wanted to buy small machine for drawing thread from cotton and machine for making lozenges.

Inquiry No. 8663.—Wanted to buy file cutting machines.

Inquiry No. 8664.—Wanted to buy game boards.

Inquiry No. 8665.—Wanted to buy comb making machinery.

Inquiry No. 8666.—Wanted to buy screw making machinery.

Inquiry No. 8667.—Wanted to buy needle, pin and pen machinery.

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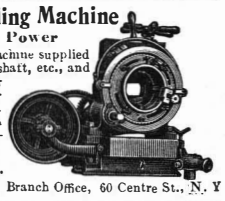

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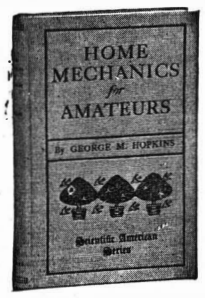

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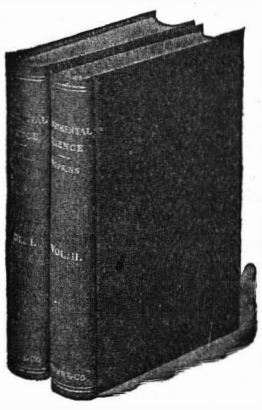

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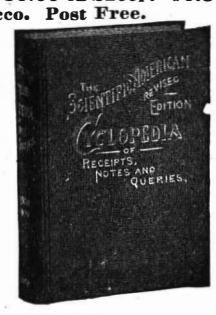

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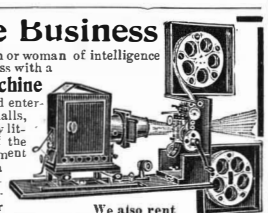

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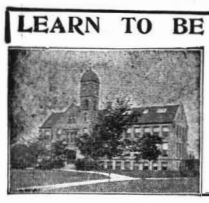

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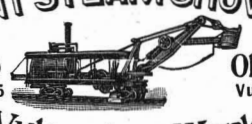

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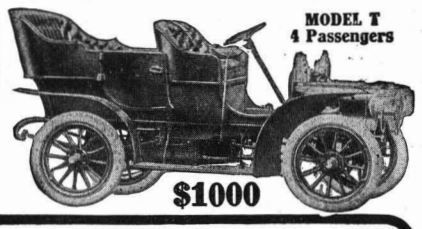

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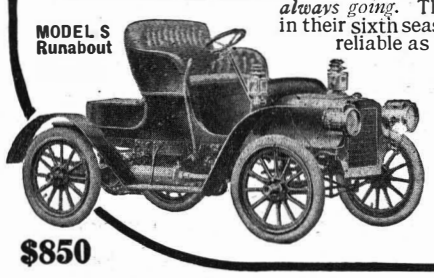

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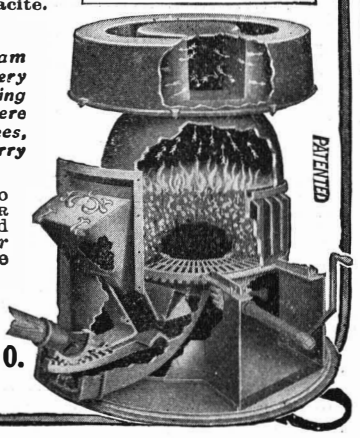

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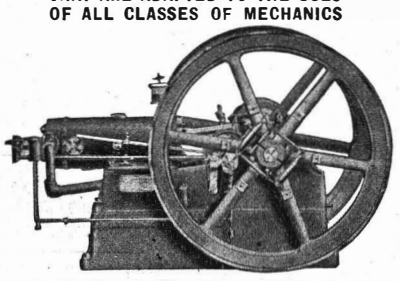

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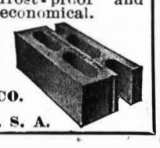

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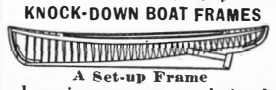

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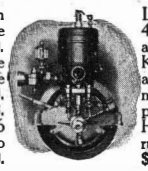

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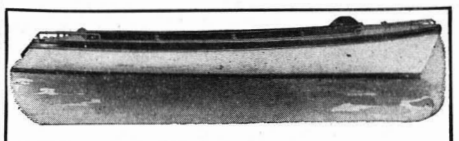

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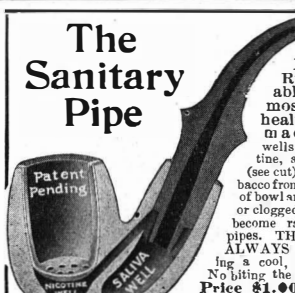

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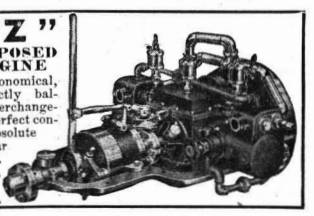

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